

N. A. Wood

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CONTENTS

	PAGE
Aeronautics of Bird Flight (with fifteen ill.).....	Sterling Bunnell 269
The Wood Ibis in Yellowstone National Park (with one ill.).....	Joseph Dixon 288
The Territorial Concept in the Horned Owl (with one ill.).....	Loye Miller 290
The Pellet Analysis Method of Raptor Food Habits Study.....	Paul L. Errington 292
Critical Notes on some Yellowthroats of the Pacific Southwest (with one ill.).....	A. J. van Rossem 297
FROM FIELD AND STUDY	
The White-tailed Kite in Marin County, California.....	C. Hart Merriam 301
House Finches Eating Watermelon.....	M. P. Skinner 301
The Cardinal in Oregon.....	Stanley G. Jewett 301
The Common Mynah Breeding in Los Angeles.....	G. Willett 301
The Asiatic Mynah in Los Angeles, California.....	Loye Miller 302
The Cassin Auklet Breeding off the Coast of Oregon.....	J. C. Braly 302
Observations upon Hummingbirds.....	Leroy W. Arnold 302
A Northwestern Race of the Mexican Goshawk.....	A. J. van Rossem 303
More about the White Pelican on the Texas Coast.....	J. J. Carroll 304
Nesting of the California Pigmy Owl in Oregon.....	J. C. Braly 304
EDITORIAL NOTES AND NEWS.....	305
MINUTES OF COOPER CLUB MEETINGS.....	305
INDEX TO VOLUME XXXII.....	307

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A BI-MONTHLY MAGAZINE OF
WESTERN ORNITHOLOGY

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COOPER ORNITHOLOGICAL CLUB

VOLUME XXXII

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AERONAUTICS OF BIRD FLIGHT

WITH FIFTEEN ILLUSTRATIONS

By STERLING BUNNELL

We are now in the dawn of the aerial age and as we are air-minded and our curiosity is kindled to learn the art of flying, perhaps by observing the birds, those skillful veterans of aviation, we may be shown the secrets of flight which Nature through the ages has evolved.

Ten years ago when I learned to fly and use the aerial ocean as a playground many of the mysteries of bird flight, which in boyhood days had thrilled me with awe and envy, began to clear and my early interest in ornithology turned toward an inquiry into how birds fly.

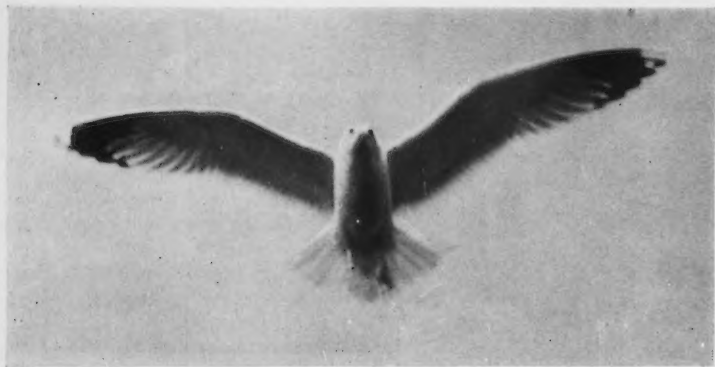


Fig. 94. THE BIRD CAN SHOW US HOW.

So familiar are we with the flight of birds that we have lapsed into the habit of thinking it beyond our comprehension and so have let it go at that. By thinking, however, in terms of aerodynamics derived from aviation the maneuvers of birds may be readily understood. Therefore, if we start with the simpler problem of learning to fly an airplane, the way in which birds fly will be unfolded to us. The airplane motor and propeller furnish the forward speed, and the uplift is provided by the wings acting on the rush of air caused by the speed of the plane. The wings

are slightly tipped in a forward and backward direction so their under surfaces face slightly forward. This angle with the horizontal is called the incidence and, together with the wing area and speed, gives the plane the lift. In flight the support given by the air pressure is firm and ample, but should the plane slow down to stalling speed it will immediately fall. Should the motor stop, the pilot merely noses his plane downward until it glides down hill and so maintains the all-necessary speed which furnishes the air pressure that acts on the wings and supports the plane. Thus, if a plane is one mile high the pilot can safely glide ten miles to a landing field.

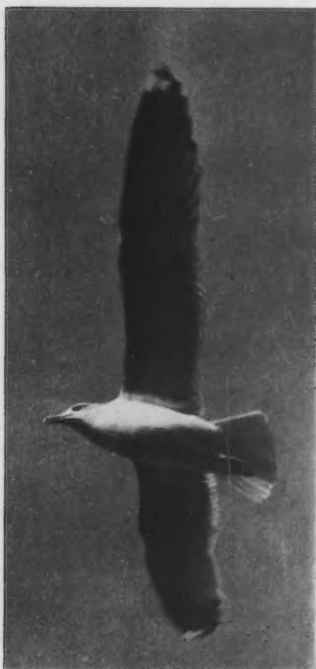


Fig. 95. THE SOARING BIRD IS REALLY GLIDING DOWNWARD IN AN UPDRAFT. THIS GULL WAS PHOTOGRAPHED ON THE WINDWARD SIDE OF A FERRYBOAT.

which the wind blows constantly, and by utilizing the updraft so produced, man has remained aloft in a glider as long as fifteen hours.

Once while on a hilly seacoast fronting to the north and with a north wind blowing, a long line of pelicans came along the coast in my direction, sailing very low and with motionless wings. On they came, undulating up and down with the rolling contours of the gullies and ridges, and to my surprise passed directly over my head although I was in plain sight. They had found an upshoot of air fringing along

Mysteries of soaring flight. First let us solve that oft debated problem, "How does a bird fly without flapping its wings?" We have all stood on the upper deck of a ferry boat while a sea gull but an arm's length away remained beautifully poised on motionless wings keeping up with the boat even in the presence of a stiff side wind. There may be fifty of them at once, all with motionless wings and all keeping steadily abreast of the moving boat. Should one but glance out from the other side of the boat the mystery will be solved, for here all the gulls are flapping their wings. As the wind strikes the side of the boat it shoots up over it and down again on the other side. The motionless gulls are riding the updraft while the flapping gulls are working their passage in the downdraft. As a gull is light and has plenty of wing area, an efficient wing curve and low resistance, his gliding angle is very low compared with the one-tenth of a plane. He does not require much of an updraft to allow him to remain level with the boat while he is really gliding downward in his relation to the air. With a very low gliding angle a bird in still air would descend quite slowly. If the speed of an updraft exceeds this speed of the bird's descent when gliding, it is apparent that when gliding in such an updraft the bird can execute maneuvers and can even ascend without ever flapping his wings.

Man uses this principle in his glider, which is a very light motorless plane with a low gliding angle. A range of mountains is selected against

those hills and preferred, even in the face of danger, to travel without effort along this rather than to leave it and be required to flap their wings.

On a ridge of hills stretching along the Pacific Ocean I had often noticed an abundance of large hawks and marveled at this because here where the weather was too bleak for small animals to thrive the food of these birds was scarce. Finally it dawned on me that the hawks lived there because they were lazy. The constant stiff breeze from the ocean against the hills furnished them by its updraft effortless transportation throughout their domain.

Once on a still, cold, foggy morning while deer hunting in the mountains we came upon several dozen turkey buzzards in a cañon grouped on the branches of a tall dead tree. It was suggested that some hunter must have killed a doe, but this was not the correct explanation. The breast muscles of a buzzard are small and the wing area tremendous, so the effort in flapping such wings is fatiguing. As there was not a breath of wind to aid them that morning they preferred to roost. The wing muscles, which in fact constitute the breasts, are small in all soaring birds, so in the buzzard they are not sufficiently powerful to flap the wings for long. Later, a breeze sprang up and straightway the buzzards deserted their tree and scattered over the ridges where they were seen to be circling, but invariably on the windward sides of the ridges. Whenever one was seen to leave such a location of updraft he was observed to busily flap his long wings until he reached another upward current on the windward side of some ridge or peak, where again he could sail about in leisure. Putting this to practical use the direction of the wind may be told by observing on which side of the peak the buzzards sail.

Still later this same morning the fog lifted and the sun shone hot. By ten o'clock wavering atmospheric lines of heat bordered objects of the landscape and then it was that the turkey buzzards were seen to sail widely over the cañons irrespective of the upshoots of wind against the hills. Everywhere, in response to the sunshine, columns of heated air were rising and the air became soarable. These updrafts of heated air were amply sufficient in speed for the buzzard with his low gliding angle to sail about in them and even to gain in altitude. Such updrafts, due to heat, which are familiar enough to pilots, make one when flying over a heated valley bump in and out of one rising column after another, with the feeling of jolting along in a vehicle over a rough corduroy road.

Sea gulls invade the city of San Francisco as mendicants from the bay, seeking donations of food. Flocks of them on warm still days are often seen circling over certain spots in the city, where air is heated by reflection from pavement and walls of buildings and protected from winds. Here with motionless wings they sail round and round, flapping their wings only when sailing away from the location. Sensitive as they are to air currents they have found an updraft of heated air in which flying is but easy gliding, so there they collect. The updraft is shown by the smoke from the many chimneys, which ascends rapidly where the gulls are sailing and does not do so where the gulls are compelled to flap their wings.

The above examples illustrate that birds soar by means of updrafts, caused from either wind influenced by the shape of the terrain or from convection currents of heated air. There are, moreover, other principles involved in soaring flight, as we shall soon see.

Wings of airplanes and birds. Let us now consider what has been learned experimentally about the shape and action of wings of airplanes and see how the same principles have long been present in the wings of birds.

A wing with flat plane surfaces, as in the early airplanes, is poor in efficiency, for it sets up a great swirl of eddies and pull-backs, especially on its upper surface. The form found to give the greatest uplift and the least resistance is the shape of wing now generally adopted in airplanes, fairly thick with a blunt edge in front and a gradual taper to a thin trailing edge at the rear. It has a decided curve from



Fig. 96. NATURE'S WING CURVE. THE WING OF A DUCK CHECKS WELL WITH THE WING CURVES DEVELOPED BY MAN FOR MAXIMUM EFFICIENCY AT LOW SPEEDS SUCH AS THOSE OF BIRDS.

front to rear called the camber, with the convexity upward, so that the lower surface is straight or concave and the upper convex, and the greatest degree of curvature is in the forward third. The tips of the wings are tapered also to diminish resistance.

For the lower speeds, such as those of birds, a concave under surface gives greater lift. In high speed airplanes the under surface may be slightly convex.

Knowing how wonderful are the adaptations of Nature, it is not surprising to find in the shapes of the wings of birds these same characteristics that make for efficiency in the wings of airplanes. Birds' wings show the same thick front edge, formed by the thickness of the bones and muscles and short-cropped backward curving feathers. Projecting backward from this in a good curve or camber are the long wing feathers. Several rows of shingled feathers or wing coverts furnish the gradation in thickness from front towards the rear edge.

This pattern of wing is carried out even in the shape of the individual long wing feathers or primaries. The front vane of each of these feathers is narrow, so the thick shaft is located at the entering edge, and there is a good camber and a tapering tip. As in the wing of an airplane the bird's wing is also tapered at the tip and those with blunt wing tips, such as the turkey buzzard, have interdigitations which increase efficiency and cumulatively act as one tapered end.

The camber of a wing in addition to giving lessened resistance contributes in soaring birds to the uplift, as we shall soon see. A thin flat surface or plane held horizontally in the wind will have no tendency to move up or down. If, however, the surface be curved or cambered it will travel with a measurable force in the direction of its convexity. It is due to this principle that clothes on a line in a strong wind stretch out in a position higher than the line and that a flag bellies in undulating waves down its length.

In wind the moving body of air is held back in its lower levels by the irregularities of the terrain, so that its speed close to the land or sea is least and becomes greater as the altitude increases. The wind thus held back by the earth becomes rough and rolling on its course and is full of up and down components, which constitute the internal workings of the wind. The downthrusts of the wind are parried by the convex surface of the well cambered wing of the soaring bird, but the upthrusts are caught by the concave parachute-like under surface and add to the uplift. Also, as each long wing feather is valved against the next, the wing is impervious to the upward gusts of wind, but some of the downgusts may pass between the feathers. By virtue of the camber and this valvular action of the feathers in selecting only the upthrusts some birds so utilize the roughness of the wind as to gain from it a material uplift. Thus, soaring birds not only utilize upward currents of air from wind and heat, as already mentioned, but also profit by the internal workings of the wind, and this brings us to the flight of that king of all soaring birds—the wandering albatross.

Peerless flight of the albatross. Month after month this marvelous mariner sails the wide ocean for thousands of miles, resting only in the breeding season on certain islands, and on the ocean only when his indispensable ally, the wind, ceases to blow.

As mentioned above, there is a difference in the speed of the wind, low down where it lags on the water and higher where it is freer, and this is part of the secret of the albatross' marvelous flight. In addition the wind traveling undulatingly over endless parallel ridges of ocean swells that lie always at right angles to its course becomes rich in vertical components or so-called internal workings. Such air is well adapted to the selective action of birds' wings by virtue of their camber and to a lesser degree the valvular action of the wing feathers, so that the effects of the many little upthrusts are accumulated and furnish the bird considerable support while he swiftly glides.



Fig. 97. POSITION ASSUMED BY THE INSIDE WING IN MAKING A TURN. THE TIP ACTS AS A RESISTING FRONT TO TURN THE BIRD ABOUT. THE TORTION OF THE WING TAKES PLACE IN THE TWO JOINTS BEYOND THE WRIST.

With these two wind factors in mind, let us watch the albatross in his ceaseless circling. Now he is high over the ocean facing into the wind against which he is traveling. The tip of one of his long narrow wings is seen to bend slightly upward, with the result that he makes a graceful banking turn and faces backward and with the wind. He is then high above the ocean where the wind has great speed and, as he sails downward with the fast wind, he gathers in his backward descent terrific speed. Now with this great speed to his credit he turns in a wide arc close to the waves until again facing against the wind and in the direction in which he is traveling. Being now in the slowly moving surface wind and also well provided with plenty of surplus speed he travels forward for a great distance so close to the water that he fairly skims the waves. His speed in this low layer of air sheltered from the resisting high wind lasts him until he reaches a position in advance of that at which he started. Then before his speed is exhausted he by a slight turning of his wrists zooms high in the air again and well in advance of his former point. He now repeats the same cycle and so keeps sailing ever in wide circles, gathering speed from the high winds and using it in his long advances in the shelter of the low winds. Thus, he utilizes this difference in the speed of the wind at high and low levels and also prolongs his long swift glide by advantageously using the internal workings of the wind.

Flight by flapping of wings. Let us now turn from soaring methods and consider the flight of the majority of birds, which is by a flapping of the wings.

It may be thought that birds can fly vertically upwards like helicopters, but few have sufficient strength for this. The hummingbird is an exception, as his pectoral or wing muscles, which constitute a bird's breast, are for his size so tremendous. He is like a scout airplane with an overly powerful motor. The pigeon, which also has a powerful breast, can ascend almost vertically for forty feet. So also can the mallard duck by a sudden upward rush, when he is flushed from the marsh, but the bird then flies off in a more gradual ascent, as such upward spurts cannot be continued. If a sparrow be placed in a smooth chimney a yard in diameter he will be unable to escape, as a vertical flight of more than about four yards renders him exhausted. When birds fly upwards, even for so short a distance as to a telephone wire, they ascend circling with a moderate slope, as if climbing on a road with a certain per cent of grade. Even the short flights in aviaries do not exceed forty degrees in steepness. It requires too much power; and we shall soon see that aside from the first flush, the flap of the wing is not to raise the bird but to give him forward speed, so that in ascending he is really gliding upwards at an easy angle.

Among the insects are many that are able to fly vertically upwards, but insects differ from birds in several essentials. Their specific gravity is less and the relative strength of their wing muscles is much greater; also, the rates of wing vibration far exceed those in birds, as evidenced by the high-pitched hum of the wings of many species.

When a bird flaps his wings the air thus set in motion is not forced downwards but backwards. If the flapping of the wings were to raise the bird upwards in the air, as is popularly believed, we would notice that its body would bob upward at each beat of the wing. But this is not the case, except in landing and taking off and in stationary fluttering. In flight the level of the body scarcely changes with the wing beats. For instance, how often have we seen a duck or a cormorant fly along so evenly, in spite of its powerful wing beats, that its body traveled in a straight line across the sky.

The breast muscles correspond to the motor and the beating of the wings to the whirling of the propeller in an airplane. They furnish the forward speed and not the uplift. The real support of the bird in the air while flapping its wings is furnished by the gliding action of the wings on the air, just as it is with a mono-

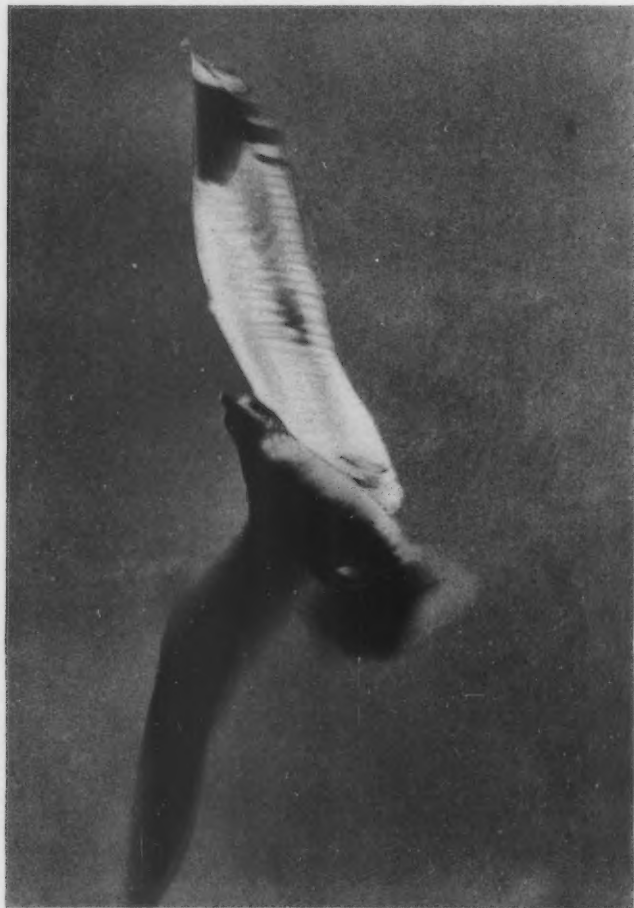


Fig. 98. ADVANTAGES OF BIRD OVER PLANE IN VERSATILITY OF MOVEMENTS OF THE WINGS.

plane. The wings act in this gliding function continuously throughout the wing beat irrespective of whether in a downward position or raised in a sharp dihedral angle.

The action of the wings in furnishing forward speed is like that of two fans directed backward. As the front edge of the wing is stiff and the wing feathers are

elastic, a sort of sculling action is given to the air. This sculling action is intensified in some rapid flyers, such as doves or falcons, by having the long tips of the wings directed backward. As the air is fanned or sculled backwards the bird gains his forward speed and with this obtains his support on the air, just as does the monoplane, as explained at the beginning of this article. The flapping bird is really gliding while forcing himself forwards by his sculling. Most birds with long wings, as easily seen in the gull, flap their wings principally in their outer thirds for propulsion, while the inner two-thirds of the wings are fairly steady for gliding action or support, like the wings of an airplane.

We have seen how a large breast indicates powerful wing beats, as in the hummer, quail, pigeon, duck and water ouzel; but where are the large muscles that raise the wings? There is scarcely any meat on the back of a duck. So long as a bird has forward speed he does not have to raise his wings. His wings are set at an angle of incidence, so he need but relax his breast muscles and they will fly back from the pressure of air on their under-surfaces.



Fig. 99. TAKE-OFF FROM THE GROUND WITH A JUMP AND THEN A FLAP. WINGS ARE ABOUT TO FLAP.

Take-offs and landings. Most birds are able to make far better take-offs and landings than can airplanes. The latter in taking off must dash along the ground until sufficient speed is gained for the wings to furnish support, and in order to continue gaining in speed they must in rising maintain a low angle of ascent. Birds also must gain flying speed before they are well launched in flight. This they accomplish in various ways. When on an elevated perch or rock an initial dive readily furnishes the speed, consequently trees and cliffs are the natural roosting places of birds. Sea birds in taking off from their rookeries in high cliffs fly precipitously downwards for hundreds of feet to gain great speed. They level off just above the water and shoot far out over the ocean. Take-offs from the level ground, however, require more effort. Some gain sufficient speed at once by an initial jump and a burst of extra powerful propulsive wing beats, but others must

with great effort add some helicopter vertical action to their initial wing beats before accelerating to the necessary speed for easy flight. A few birds have take-offs like those of airplanes, such as the mud-hen, which must run over the surface of the water spattering and fluttering until finally it exceeds its stalling speed and gains the air. Even the albatross has difficulty in launching into his real home, the air. If he is on the deck of a ship the gunwale is a sufficient barrier to hopelessly prevent his escape; and strangely enough the unnatural motion of a ship, so different from his own graceful curves, makes him seasick. To take-off from his nesting ground, such as the flat surface of Laysan Island, he must first



Fig. 100. TAKING OFF BY DIVING FROM AN ELEVATED POSITION ON A ROCK.

run along the ground a great distance. So also in rising off the sea he runs along the surface of the water. If, however, the take-off is in the face of a strong wind it is much easier for him to rise. The necessary speed to be gained is with reference, of course, to the air and not the land, as it is immaterial whether the speed is that of the moving bird or of the wind. This speed relation between bird and wind applies also to airplanes and wind. In some of the transoceanic flights the pilots waited several days for the proper wind for taking off in their heavily laden airplanes. In a strong wind an airplane can rise after a very short run and so also can an albatross in a gale take right off from the crest of a wave.

Like airplanes all birds land and take off into the wind. The speed of the wind is then added to their own speed, but if the landing or take-off is made with the wind the speed of the wind is subtracted from that of the bird or airplane and there is not sufficient left for support in the air. Even the little sparrows in the grass when the wind is blowing take off and land into the wind, turning at the same time if their course is in another direction. Many kinds of sea birds can be readily caught when on the ground by running toward them down the wind, as they must then face the intruder in their take-off. The nesting rookeries of hordes of sea birds of soaring flight, such as boobies, frigate birds and pelicans, are placed on a

slope or exposed flat where the force of the wind or the updraft will facilitate their landings and take-offs and also aid the young in their debut into the air. On one such slope on San Benedicto Island I remember seeing at each gust of wind the young frigate birds spread their long wings, reveling in the feel of the wind and even ascending in the stronger gusts a foot or two in the air and settling back again. Eventually, one after another sailed out into that moving medium of air which was to become their home.

It is interesting to watch birds when landing, as they do it much in the manner of airplanes. An airplane glides down evenly, approaching the ground closer and closer as it loses flying speed until finally just as the stalling speed is reached it is practically on the ground, along which a short run follows as friction absorbs the inertia. Watch, for instance, a blackbird alighting on a lawn and see how he prolongs his glide until, when but a few inches above the grass, his flying speed is spent and with one flutter he gently alights. Other birds, as pigeons, flutter down parachute-like for several feet with wings in a sharp upward or dihedral angle for better stability and with tail broadly spread to check the drop.




Fig. 101. GULL DESCENDING PARACHUTE-LIKE, WITH WINGS UPWARD IN DIHEDRAL ANGLE FOR STABILITY.

Just as the airplane can swoop up a slope and land without a run, so does a bird swoop up to a perch in a tree and land perfectly balanced. If flying downwards to a perch beneath him, however, he checks his speed with a little flutter and accurately lands on the twig. At close range in an aviary the method of checking speed and gracefully landing on a perch may be beautifully seen. Just as the perch is reached both wings and the tail are widely spread in a broad resisting front. The bird stops and lands so accurately on the perch as to excite the envy and admiration of any aviator. Clumsier relatives like the mud-hens check the speed of their glide by plumping breast-on into the water with a loud splash and plowing along the surface until halted.

Maneuverings in flight. We have now to consider how the bird changes

his direction in flight and maneuvers so expertly in any direction. Again by starting with the airplane, which in this day all of us should know how to fly, we can better understand the controls of a bird.

As an airplane flies in three dimensions it has in its tail both a vertical rudder and two horizontal flippers and so can turn sideways, upwards and downwards. In turning in the horizontal, banking is necessary as in a race-track to prevent skidding, and this control of rotation on the airplane's longitudinal axis is by the flippers at the rear edges of the wings, called ailerons. Thus, to make a turn to the right one starts with rudder to the right, left aileron down and right aileron up. Then when in a vertical bank the tail flipper is elevated and the turn is completed. The controls which, of course, must throughout the maneuver be nicely



Fig. 102. A LANDING AT STALLING SPEED.

synchronized are neutralized as soon as their effect has been accomplished and even reversed in recovering from the turn. Birds, however, are devoid of rudder and though some have a tail for a flipper its upward force is lacking and in many the tail is but rudimentary. Its principal functions are that of the horizontal stabilizer of an airplane, to furnish additional supporting surface in flight and to act as a brake. In the latter function the body of the bird is tipped up so the outspread wings and tail present a broad front that at once stops the bird. The guiding is done by the wings and these have many motions which are lacking in the airplane. They may be raised or lowered, pointed forward or backward, and by rotating on their long axes may change their angle of incidence at will.

If a soaring bird wishes to incline downward, he directs his wings slightly backwards. This places his wings or lift behind his center of gravity, which is normally opposite the wings, and being thus nose-heavy, he aims downward. Similarly, to direct his flight upward he places his wings forwards. This shifts the lift to in front of the center of gravity, thus making him tail-heavy and he aims upwards. By slightly increasing the angle of incidence in the wings when they are either forward or backward their lift in this position will be accentuated, thus accelerating the maneuver.

To make a turn the outside wing is rotated at its tip or as a whole so as to

increase the angle of incidence and, therefore, to increase the lift on that side, just as the aileron acts in an airplane. The incidence is also decreased in the inside wing, thus robbing it of lift, and the bird assumes the banked position. Simultaneously the wings are pointed forward to give tail-heaviness and this acting by centrifugal force directs the bird around the turn.

Birds use another factor in turning, much as the oarsman holds one oar to turn his boat about. The wing has the ability, by a motion at the two joints beyond the wrist, to rotate its tip until its under surface faces directly forwards (fig. 97), just as we can with outstretched arms and hands, held palm downward, direct



Fig. 103. GULL TURNING. WHILE BANKED THE WINGS, OR LIFT, ARE PLACED FORWARD OF THE CENTER OF GRAVITY AND THE BIRD BY CENTRIFUGAL FORCE NOSES BACKWARD AROUND THE TURN.

the under surfaces of our fingers forwards while the wrists scarcely turn. Even the individual four or five last wing feathers rotate toward a vertical plane, as does also the wing tip as a whole, so a resisting front is presented to drag that wing back and turn the bird.

Birds making a sharp turn on a glide are seen suddenly to drop the inside wing and rotate the down-pointed outer half so that it faces directly forward as a brake, thus pirouetting the bird around.

Flapping birds execute maneuvers similarly to gliding birds, but in addition accentuate the lift of the wing or wings where necessary by extra powerful wing beats when in the above angulated or rotated positions.

All birds bank well in turns. A familiar example is seen in the flash of white of the under surface as a flock of sandpipers wheels away.

Should one desire to study the principles of bird flight, as in a slow moving picture, he need but visit an aquarium and watch the fishes. Their many devices for motive power and for guidance by fins are fascinating to watch, as they make banking turns and go through all the maneuvers of birds, and with the same principles, but in their denser and, therefore, slower medium, water.

The part of the bird's wing that controls the finer degrees of incidence is beyond its forward angulation, which corresponds to our wrist. The aileron-like movement of the tip is especially noticeable in the long wings of soaring birds. The bird's shoulder-joint has much the same action as our own, with the exception that it bends farther backwards. The backward or rather upward angle which the two wings form with each other is in aviation called the dihedral angle and in airplanes



Fig. 104. NOSING DOWN. WINGS, OR LIFT, ARE PLACED BEHIND CENTER OF GRAVITY.

it is found to add much to lateral stability. If an airplane built with some dihedral angle leans to one side, the lower wing will thus present a greater lifting surface in the horizontal than will the upper wing and so will automatically right the plane. Birds when in need of better balance when the air is rough increase the dihedral angle of their wings, either in their wings as a whole, as in the pigeon, or only in the inner halves of their wings, as often in the gull. The dihedral angle is also used by birds while landing, just as they are slowing to the stalling speed and are losing their hold on the air.

Long wings held in a dihedral angle frequently show a sharp downward bend at the wrist-joint, especially when the air is turbulent. Thus, the dihedral angle of the inner half of the wing gives lateral stability and the outer halves of the wings are best placed to take advantage of the current of air which the inner halves of the wings deflect outwards. The movements of the wing are more versatile in the outer half from the wrist outwards, and thus further increase the lateral stability



Fig. 105. CHECKING SPEED BY INCREASING THE ANGLE OF INCIDENCE OF WINGS.



Fig. 106. FLUTTERING GULL MAINTAINING ALTITUDE BY FANNING AIR DOWNWARD, WITH PLANE OF WINGS ALMOST VERTICAL.

furnished by the dihedral angle of the inner half. Birds when fluttering or hovering without forward speed place their wings in a strong dihedral angle and well forward of their center of gravity, so the body hangs in a somewhat upright position. The incidence of the wings is greatly increased and especially so beyond the wrist-joint, so the flapping fans the air directly downwards, thus maintaining the lift without forward speed.

Various adaptations of different birds. Birds that do much flying from



Fig. 107. STATIONARY GULL FLUTTERING, WITH MOST OF MOTION AT WRISTS OR FORWARD ANGLES OF WINGS.

perch to perch usually have a long tail to give them a purchase on the air and so steady them. Birds like herons, may derive some stability from their long legs, as does the tight rope walker from his balancing pole. If the legs of these waders are long, the neck must be long also, so as to reach to the ground, and the tail must be short to keep out of the wet, but in flight the wings alone steer the bird and the rest of the design is not so important.

Like racing airplanes, very swiftly flying birds present a minimum surface of resistance by having small wings, and have a powerful motor in the form of a large

breast. With such small wing surface the speed of vibration must be great, so that a whirring sound is produced, as in the quail or duck. The more rapid the vibration, the higher is the musical pitch, until the record is reached in the hummingbird, which actually hums. Birds with these proportions are also the swiftest gliders and in fact have so much weight of motor for the small wing surface that their stalling speed is high. Should they attempt to glide slowly they would drop.

Other birds, such as hawks, when wishing to glide steeply with terrific speed diminish their resistance by half closing their wings. When an airplane is in such a dive the pilots say the wires sing "Nearer my God to Thee". Falcons, eagles, nighthawks and tropic birds in diving with this harrowing swiftness produce with their wings a shriek similar to that of the airplane.



Fig. 108. DIHEDRAL ANGLE OF INNER HALVES OF WINGS FOR LATERAL STABILITY.

In gliders the long and very narrow wing has been adopted as having less resistance, as it causes fewer eddies and pull-backs than does the broader wing. This explains the long narrow wings, like the blades of the boomerang, of such swift sailing birds as the shearwater, albatross and the swift.

The flight of some birds, such as petrels, swallows, nighthawks, flycatchers, snipe and woodcock, is quite erratic, darting jerkily this way and that like a bat or a butterfly. The breast muscles in these birds are very strong and have long leverage, so that each wing beat shoots the bird along, and the beats of each wing are more or less alternately forceful. Such birds are most skillful stunt flyers and many catch insects on the wing. "Wing-overs", "Immelman turns" and most of the stunts of the aviator may well be seen in the flight of the swallow.

Many finches, shrikes and woodpeckers fly undulatingly in a series of swoops. This manner of flying is from flapping the wings intermittently in the intervals between the crests of their line of flight and resting between each of the spurts.

Water birds with labored flight, such as grebes, loons, murres and auklets, are usually seen flying close to the surface of the water. This is taking advantage of the firmer support furnished by the air which the water blocks as it is displaced downwards by the incidence of the wings.

Some birds including penguins, murres and water ouzels are able to fly under the water. Penguins bank and turn most gracefully under water, flying about with their short thick wings much as other birds do in the air. The shape and size of their wings are perfectly adapted for flying in water and so must be short and thick like the propeller blades of a boat, as compared with the long slender blades of the propeller of an airplane.

On moonlight nights on the ocean I have seen the shearwaters and albatrosses still flying as in the daytime, so it is probable that when the ocean is rough they fly continuously. This necessitates a special sort of wing muscle, like the muscle of the heart which works constantly without rest from birth until death. Muscle adapted for continuous action like hearts or breasts of birds that spend much of their time on the wing is of dark meat. For instance, the tail muscle of a rattlesnake whose function is to vibrate the rattles for long periods, is dark, while the meat throughout the rest of his length is white. Also, birds that run more than they fly, like quail, chickens and turkeys, have dark meat in the leg muscles and white meat in the breast.

The speed of birds is not great; small birds fly about 30 miles an hour and gulls about 25 miles an hour. When an airplane at 90 miles an hour is flying along with a flock of ducks, the ducks appear to the pilot to be flying backwards. If, however, they are gliding downwards or flying with the wind their ground speed may exceed 100 miles an hour.

Colonel Munson who paced ducks with an airplane claims that canvasbacks fly 72 miles per hour, sprig 65, mallard 55, and swans 45.

As seen from an airplane birds are creatures of the earth's surface and seldom stray far above it. They seem to be part of the evolutionary biochemical reaction between the surfaces of three media—land, water and air; in fact, animal life and plant life are seldom found far from the juncture planes of these three media. Hawks and buzzards are sometimes seen at 1500 feet above the earth, and migrating birds have been seen at great altitudes, but they have been at such times crossing mountain ranges and so have not been far above land.

Colonel R. Meinertzhagen after interrogating six hundred English aviators concluded that most birds migrate at altitudes under 3000 feet, with the majority well under this altitude, and that they usually fly below the clouds, so as to keep landmarks in sight. In only thirty-six instances were birds seen over 5000 feet and in only seven recorded cases were they seen between 8500 and 15000 feet.

Flying is laborious at high altitudes where the air is thin. The familiar Jenny airplane reached its maximum height at about 5000 feet and many modern planes cannot exceed an altitude of 10,000 or 12,000 feet. Therefore, most of the birds that soar, with such few exceptions as the condor of the Andes, which has the greatest wing area of any bird, are found at lower altitudes. An example of the poor flight of birds in high altitudes is seen in the method of quail hunting in the Andes at 15000 feet, where a crowd of people and dogs run after the quail which averages but three flights and then is so exhausted that it can be picked up.

Now that we have indulged in thinking of this most delightful means of locomotion are we over-stepping in philosophizing that the happy creatures are the agile ones and those that fly, while the sordid creatures are the slothful ground folk and those that burrow?

In the line of a little propaganda for aviation: Have you ever thought when thrilled with the music of the bird chorus at daybreak that it is an expression of their joy as they are about to fly?

San Francisco, California, June 4, 1930.

THE WOOD IBIS IN YELLOWSTONE NATIONAL PARK

WITH ONE ILLUSTRATION

By JOSEPH DIXON

On June 28, 1930, George M. Wright, Ben H. Thompson and the writer found a lone Wood Ibis (*Mycteria americana*) feeding in a shallow pond near the junction of the Yellowstone and Lamar rivers in Yellowstone National Park.

In the United States this species breeds along the hot moist bottomlands of our southern states where they border on the Gulf of Mexico. Its presence in mid-summer in Yellowstone therefore came as a distinct surprise to us, but in going over the literature we find that there are two other similar records for this species in that region. Mr. A. C. Bent, in his "Life Histories of North American Marsh Birds" (Bull. no. 135, U. S. Nat. Mus., 1926, p. 65), states: "Stragglers . . . have been taken or noted north to Montana (southwestern part of the State, June 18, 1911); Wyoming (Yellowstone, Grand Canyon, July 16, 1925)."

The bird which we had under observation for several hours was doubtless the same individual that had been seen by various persons at Rainy Lake, where a ranger reported that a black bear had stalked the ibis and had approached to within ten feet of the bird before it became alarmed and took flight.

The unusual tameness of this individual contrasted with Bent's statement that "the wood ibis is an exceedingly shy bird". The further fact that the ibis, when under close observation, was found to have its neck and the posterior portion of its head still covered with dusky feathers of the immature bird, taken together with its tameness, leads me to conclude that it was a bird in its second year, since it lacked the brown tipped scapulars and tertials that are to be found in the first winter plumage and had not as yet acquired the scaly, bare head and neck of the adult bird.

When ready to forage, the ibis selected one of the smaller shallow ponds free from entangling tules. Here it waded sedately along, keeping in water that was from six to fifteen inches deep (see fig. 109). At intervals it reached down with its long, heavy, curved bill, sometimes submerging its entire head, in search of living fresh-water snails. Having located a mollusk, it separated it from the mud or moss and then, holding it in the tip of its flexible bill, sloshed it back and forth in the water, rinsing and freeing it from all débris. Then, giving its bill a little flip, it caught and swallowed the morsel after crushing the paper-like shell of the snail in its strong mandibles. At other times the bird worked over masses of algae with its bill for water beetles which it caught and then swallowed. When swallowing a large morsel, the bird's bill was sometimes elevated and the neck extended, although normally the food was swallowed without the bill being raised.

When foraging, the ibis moved its feet very deliberately. First one foot and then the other was slowly raised, the leg thrust forward and put down into the water again, with the minimum of disturbance. Such a procedure was helpful when stalking young frogs, which I twice saw the ibis successfully accomplish.

By 8:30 o'clock in the evening the ibis showed signs of wanting to go to sleep for the night. There were numerous bare granite boulders protruding above the water out in the pond where the ibis was feeding, and we expected that it would spend the night perched on one of these isolated rocks, away from the shore. However, the bird chose as its roosting place an open stretch of the pond where the water was about one foot deep and where there was no screening vegetation behind which

a lurking enemy might approach. Here the ibis settled itself for the night, lifting one leg slightly and drawing its neck down so that its heavy bill rested on its shoulders, and went to sleep. However, it was sensitive to the slightest noise or movement made within thirty feet of it, and, when alarmed, the bird would rouse up and wade out into the deeper, open water away from the shore.

A Horned Owl visited the pond while we were watching, but made no attempt



Fig. 109. WOOD IBIS FORAGING IN A POND IN YELLOWSTONE NATIONAL PARK.

to molest the ibis. Muskrats swam about within six feet of the ibis but the bird paid no attention to them. By ten o'clock in the evening the ibis had settled itself for the night and we left it, but when I again visited the pond at 4:38 o'clock the next morning I found the bird actively foraging in another shallow pond near-by.

Berkeley, California, August 22, 1930.

THE TERRITORIAL CONCEPT IN THE HORNED OWL

WITH ONE ILLUSTRATION

By LOYE MILLER

Most field workers in ornithology come soon to recognize that individual birds commonly lay claim to definite feeding areas which they try to defend against intruders of their own kind or against those of kindred interests. I have often noted this phenomenon among the various owls (especially with Horned, Spotted and Pigmy owls). From some point within his baronial estate the owl may boom forth his proclamation to the strigine world and consciously or unconsciously warn away all intruders. Only as one invades this particular territory with an imitation of the owl's note does he get an active response from the claimant.

During the present summer, in Holcomb Valley of the San Bernardino Mountains, I observed an interesting and entertaining manifestation of this proprietary

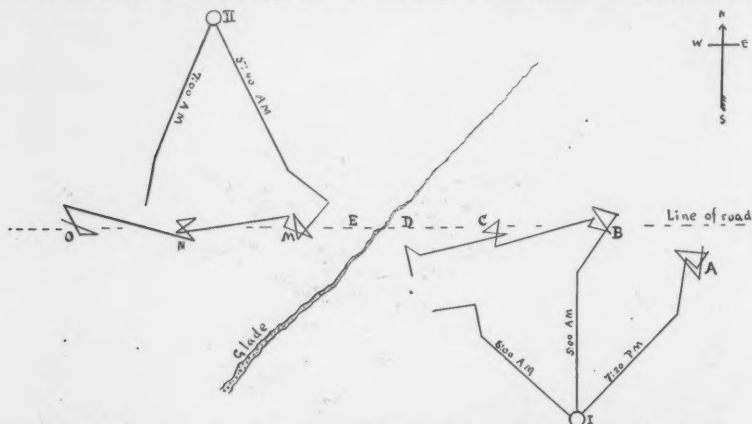


Fig. 110. DIAGRAM OF MOVEMENTS OF TWO HORNED OWLS (1 and 2) WITHIN THEIR RESPECTIVE AREAS. NUMBER 1 REACTED AT SUNSET, 7:30 P. M., AND AT 5 A. M. AND 8 A. M., NEXT MORNING, EACH TIME APPROACHING FROM ITS STATION AT I. NUMBER 2 RESPONDED AT 5:30 A. M. AND 7:30 A. M., COMING FROM ITS STATION AT II. THE DIAGRAM IS NOT QUITE ACCURATE IN SCALE. THE RADIUS OF EACH AREA WAS ABOUT ONE-FOURTH OF A MILE.

instinct. The species concerned was *Bubo virginianus pacificus* and the dates June 26 and 27. We made camp at Saragosa Spring at 7600 feet (station A, fig. 110), and immediately after sunset I began giving the four-note "hoot" of the Great Horned Owl. Within a few minutes a male bird answered from the southwest about a quarter of a mile away (station I). Calling continued, and this bird answered from a nearer point and then approached to within seventy-five feet and moved from perch to perch about our campfire out in the open. Each time it hooted the call was answered from where I sat by the fire. It was not yet dark, and the bird was plainly visible. Each time I hooted it turned quickly and looked in the direction of the sound. We played with him until we tired of it and slid into our sleeping bags under a juniper tree. The owl remained about until after I went to sleep.

I was awakened after the first hour or two by my restless companion who was disturbed by the noisy owl. I then heard the high pitched note and a cat-like "squawk" from the female bird. They were both about. I raised up with the

spot light and answered the birds and they both approached, the male within fifteen feet of me, on the lateral branch of a juniper scrub. The light drove them away temporarily, but not till the pinkish eye shine was noted. The birds retreated but a short distance and returned, seemingly searching for the invading owl. I drove them away again and went back to sleep. After one repetition of the performance I slept till daylight at 4:30 when, with a companion, I started for a walk down cañon at sunrise, walking almost due west along the mountain road. Two repetitions of the owl call brought the male bird's response again at station I.

We had moved along the roadway perhaps two hundred yards and the owl approached us. We stopped at B and the bird occupied several stations within fifty to one hundred feet of us, each time looking for the answering hoot. We moved to C and repeated the performance. The bird followed us toward D but would not quite come to us. We walked on to E but he would not come any farther than a point east of D. As we called repeatedly from E a second owl of slightly deeper voice answered from the northwest (station II). At M we stopped and number 2 approached, occupying several stations about us, once perching on a dead stub within thirty feet in bright sunshine.

We repeated the performance at N and at O and then continued our walk down cañon. Bird number 1 had meanwhile retired to station I and was silent. We left number 2 at O and were gone about forty minutes. As we returned toward O hooting was resumed and number 2 at once responded from his original station at II. He approached at once, flying through the open scrubby timber, and we noticed that the small birds were not particularly disturbed by his presence or actions. (The Pigmy Owl's note a short time previously had attracted eight species of birds.) We repeated the previous performances at approximately stations N and M in reverse order until we arrived at E where number 1 answered from station I.

I was taken with a strong desire to call the two birds together and see what would happen, so I moved to a point directly between them. Owl number 1 approached to within seventy-five yards, but would come no nearer. Number 2 came in from the west to about the same distance on his side, but I hooted till my throat was tired and the two owls remained each on his own side.

I finally saw number 2 fly back to the west, and we ourselves decided to go to breakfast. The sun had been up nearly three hours.

There was a poorly defined glade running obliquely through the sparsely forested country, crossing the road between D and E. This seemed to be the dividing line between the lands of these two robber barons, and neither carried his quarrel quite up to the boundary line.

CONCLUSIONS

Bubo hoots from a point within his chosen territory.

Within that territory he generally responds quickly to the note of a supposed invader.

Calls from without his estates do not bring him to the spot though they may rouse him to send out his own challenge.

The male bird is the more aggressive and is recognized by the deeper voice and more regular cadence. This point has been tested out by dissection.

When reacting to the invader, the owl is not disturbed by people. I once brought a bird to a desert camp where there were seventy-five people laughing and talking, about their several cook fires, or pointing at the owl and exclaiming at its erect horns and cat-like face.

There is honor (or fear) among thieves, for each bird seems to respect the other's territory.

University of California at Los Angeles, July 30, 1930.

THE PELLET ANALYSIS METHOD OF RAPTOR FOOD HABITS STUDY

By PAUL L. ERRINGTON

This article has to do with the progress to date (July 15, 1930) of a series of experiments carried on under the quail research fellowship established July 1, 1929, at the University of Wisconsin by the Sporting Arms and Ammunition Manufacturers' Institute and the United States Biological Survey. One of the objects of the fellowship is the determination of quail-predator relationships, and, in this connection, need was felt of testing the reliability of the pellet analysis method of studying raptor food habits. The experiments have not been wholly concluded, but recent discussions of this question make it timely to present a résumé of the data already at hand.

Experimental work was done with four Great Horned Owls, a Barred Owl, a Long-eared Owl, a Red-tailed Hawk, a Red-shouldered Hawk, and a Marsh Hawk. The aforementioned were young birds taken from this season's nests and raised to full or to approximately full size. Their growth was normal as compared with that of the nest-reared young in the wild. No young falcons or Accipiters were available, although a Cooper Hawk nestling is now being kept for future experiments.

Discussion of pellet formation by species follows.

Great Horned Owl. Owlet aged 21 days (calculated), about one-fourth grown and with primaries just coming out, seemed to retain the residue of its meals (cottontail rabbit) so long in the stomach that the bones were digested and the fur passed out in the feces. At the age of 28 days the first creditable pellet was produced. Parts of a robin and a rat had been fed the day before, both of which were evident in the pellet. From this time on, pellets gradually improved in quality, bony material showing less and less digestion as growth of the owlet progressed. Acknowledgment is hereby made of the liability to error in the initial experiments with this three-weeks horned owl, for only the one bird was had at first, and the technique was by no means flawless.

As grown juveniles, four horned owls were fed cottontails, rats, mice (*Microtus*, *Peromyscus*, and *Mus*), mallard ducks, domestic chickens, domestic pigeons, pheasants, quail, flickers, English sparrows, miscellaneous birds, snakes, and frogs. Much of this material was taken directly from horned owl nests. Emphasis was laid upon offering them the game upon which they preyed in nature, allowing them to eat it in any manner that they wished. Later they were permitted to do their own killing. No differences in digestion were noted among the four horned owls when given the same type of food.

Examples 1 to 5 might be considered representative of the horned owl experiments.

(1) Owl fasted for 85 hours. Live English sparrows then put in cage and replenished at intervals to keep available for the owl a constant supply that he could catch as he wanted them. This he was able to do without difficulty. In 74 hours he had eaten 32 sparrows; in 84 hours he had disgorged 6 pellets, in which remains of 28 out of the 32 sparrows were easily discernible.

(2) Owl fed 6 sparrows and 15 house mice (some of the latter were very immature) in 13 hours. Pellet in 24 hours, in which pellet the six sparrows and the 12 largest of the 15 mice could be recognized.

(3) Owl stuffed with 3 sparrows and 8 house mice (some very immature as

in above experiment) at one feeding. Pellet in 19 hours showing the 3 sparrows and 6 out of the 8 mice.

(4) Owl fed entire part-picked English sparrow and much meat (beef). Fed more meat after 14 hours. Twenty-four hours later fed meat with cat fur to bring up sparrow remains—if remains existed after having been retained in stomach this long. Cat fur fed also during following 24 hours. Pellet of cat fur showing no trace of the sparrow fed 70 hours previously.

(5) Owl left in cage 30 hours with adult mallard. Two pellets of unmistakable mallard composition, showing bill, feathers, and the larger broken bones rather characteristic of horned owl work.

Barred Owl. The early experiments with the young barred owl were similar to those with the young horned owl and gave similar results; pellets were retained in the stomach until the bony parts were well digested. As in the case of the horned owls, the barred owl pellets improved in quality with the growth of the young bird. The pellets of the owl at plumage maturity showed remains of practically all small game in recognizable condition. In one experiment 55 English sparrows (released alive in cage) were eaten in 154 hours. From these sparrows 17 pellets were produced in 168 hours, in which 49 sets of mandibles out of a possible 55 were counted in a hasty sorting over of the bone and feather débris. It is probable that a careful re-examination might have brought out 2 or 3 more, or even all of the missing 6.

Long-eared Owl. This owl was killed in a freak accident before much work had been done with him, but the few pellets obtained yielded the most perfect bone remains of all.

Red-tailed and Red-shouldered Hawks. These two Buteos gave the least satisfactory pellet returns of any of the raptors. Sometimes pellets were not thrown up for protracted periods of time, depending upon the amount of roughage fed. Pellets were disgorged when they became about so big, whether the next day or the next week. Fur and feather material proved to be in fair shape, though as a rule no particles of bone could be detected.

Marsh Hawk. The marsh hawk was taken when but a few days old. He threw up pellets from the beginning, regularly before 8 o'clock each morning—provided he had been fed pellet-forming material. However, if fasted subsequent to a meal, he would disgorge a pellet of any size as soon as he had extracted the nourishment.

One experiment consisted of giving the hawk access to as much food as he wanted. In 130 hours he ate a meadow mouse (*Microtus*), 2 striped ground-squirrels, a red-winged blackbird, a migrant shrike, a bluejay, and 29 English sparrows, from which he threw up 8 pellets in 149 hours. The pellets revealed qualitatively though not quantitatively the species eaten.

Compared with the owl pellets those of the marsh hawk were of poorer quality. Fur and distinctively marked feathers usually came through in recognizable condition, but the bony substance was largely digested. It might be pointed out that most of the prey fed was of this season's increase; bones of fully matured animals doubtless would better withstand digestion than the bones of juveniles. This criticism can be made of all the experiments in which sparrows were used.

What is the value of pellets in raptor food habits study? The pellet record of the common owls, to all appearances, can be accepted virtually at par; whatever an ordinary southern Wisconsin owl is apt to eat stands an excellent chance of being represented in pellets, notably in those of the smaller and medium-sized

owls. This statement is meant to include the short-eared, saw-whet, screech, and barn owls, for, while no experiments were conducted with these species, their pellets collected in the wild differed to no radical degree from the pellets of the experimental birds. A greater or less loss of delicate osseous structures—as the skeletons of *Sorex* and immature mice—can be expected in all owl pellets, but some resistant parts like lower mandibles usually persist. Feathers tend to become ground up—not invariably—in the stomachs of the larger owls; as concerns these owls, the main reliance in pellet study should be placed upon bone determination.

It is suggested that the saw-whet, long-eared, short-eared, barn, and great horned owls lend themselves especially to pellet food studies, because of the comparative partiality individuals often show toward favored roosts, under which their pellets accumulate. No such favoritism toward roosts was noted during the past winter, with respect to barred and screech owls. Incidentally, the above suggestion is intended to apply to the winter and spring months, since no first-hand information is had dealing with summer owl behavior.

The owls observed in captivity and in the wild bolted their prey whole or in the most convenient chunks they were able to get loose. Scarcely any attempts were made at skinning or picking other than the pulling out of large primaries and tail feathers and the eating of flesh away from hide too tough to tear. Heads of victims killed by the owls were almost without exception among the first portions ingested, thus rendering even more probable the likelihood that something of diagnostic importance would be contained in the pellets. Horned owls eating rabbit, duck, or domestic chicken bit through bone and all and gulped any piece that they could force down their capacious throats; pigeons, flickers, jays, rats, and ground squirrels were completely eaten at one sitting, save for a scattering of primaries, etc.; mice and sparrows were swallowed whole, or first decapitated.

As to the hawks, the pellet value seems to vary with the genus. The pellets of the red-tail, red-shoulder, and presumably other Buteos might be of some utility in supplementing data gathered by less doubtful methods, assuming that the pellets were of unquestionable origin. Bona fide Buteo pellets proved extremely difficult to find, except in nests. This was not because identifiable material wasn't swallowed, for the Buteos observed were not careful feeders. The reason was that identifiable bony material did not satisfactorily survive digestive processes, and the pellets were distributed promiscuously about the country-side. Large-scale pellet study of Buteos, therefore, is not deemed practicable.

Now let us consider the marsh hawk, principal focus of the current raptor controversy. Marsh hawk pellets, as previously indicated, generally told *what* but not *how much* prey was taken. Suppose, for instance, that a marsh hawk had been preying upon mice, ground squirrels, blackbirds, and meadowlarks. His pellets would disclose the species eaten but not necessarily the number of each species. Bones, as illustrated by pellets of free and captive birds, suffered more decomposition than fur or feathers; nevertheless, some bones or bone fragments characteristic of a species were often to be found, especially the well ossified bones of adults. The quarry last eaten before the ejecting of the pellet was always the most recognizable, whether mammal, bird, or reptile. Batrachians were a total loss by the time that any of the hawks got through with them.

Marsh hawk pellet analyses should have their chief value for the determination of *general food habits* in somewhat hurried surveys, rather than for exhaustive researches, to work out problems of economic status. The pellets are frequently available in moderate numbers at strategic locations where the hawks eat their prey—

around the bottoms of fence posts, on hay cocks, old windrows, grassy elevations, and the like. The technique of skilled analysts having adequate reference collections is required to identify the various feathers and bone fragments found in the pellets, should the utmost accuracy be demanded.

Perhaps in view of the marsh hawk's debated status, it might be permissible to digress from the subject of pellets in order to offer some data pertaining to this raptor's food habits in the vicinity of Madison, Wisconsin. For the sake of avoiding possible criticism, pellet and stomach data will be omitted. The submitted list of prey relates only to that *retrieved from the birds themselves*, either from adults irritated into dropping what they had, or forced fresh out of the gullets of juveniles in nests. Such data were acquired incidental to the study of seven marsh hawk nests (one broken up early) from June 9 to July 11, 1930. Efforts were made to visit nests every two to four days.

During this period 82 specimens were actually recovered from marsh hawks: 39 striped ground squirrels (*Citellus tridecemlineatus*), ranging in size from one-third grown to adults; 12 meadow mice (*Microtus*); 11 young cottontails (one-sixth to one-fourth grown); 8 frogs; a chipmunk; a field sparrow; a red-winged black-bird; a meadowlark; remains of 3 not positively identified mammals, two of which appeared to be ground squirrels; and 5 small finch-like birds, at present awaiting specific determination. Some hundreds of pellets gathered contemporaneously (not yet subjected to careful examination) appear to bear out the same broad ratio of mammalian to avian prey.

Did the marsh hawks kill any poultry or game birds? Occasionally they did; but poultry and game birds made up a negligible percentage of the items recorded as far as the study has progressed in the Madison environs. Evidence was seen about the nests that a couple of part-grown domestic chickens and a young ring-necked pheasant had been brought in, and an incalculable number of injurious rodents. Let attention be drawn to the possibility that easily detached feathers from a lone bird might linger several days in the nest, whereas the apportionment of a dozen or more small mammals between the nestlings might leave less visible sign to tell the story.

Returning to the topic of pellet study, it might be well to mention that the approximate status of raptors other than the owls and the marsh hawk might conceivably be ascertained by this method. Falcons (duck hawk and sparrow hawk) deposited about their feeding places pellets corresponding to their observed food habits. Duck hawks studied in the field fed exclusively upon bird life, yet their pellets were full, fairly firm, of mixed bone and feather composition, and displayed to casual scrutiny the pigeons, bluejays, blackbirds, flickers, etc., of peregrine diet.

On account of a scarcity of Accipiter data, experimental and observational, no conjecture will be advanced bearing upon the feasibility of applying pellet study methods to this genus. Note has been made, withal, that the Cooper hawk is not nearly as clean a picker as is popularly supposed; indeed the nestling now in possession spat out a very fine pellet of flicker feathers on his first morning in captivity. The mother Cooper hawk seemingly had not been overly dainty in feeding her offspring, though the youngster had been hatched no longer than four days. A nestling under observation in the wild has been yielding a good pellet about every two days. It is likely that Accipiter pellets might be of considerable value if one knew how to find them.

This article has tried to make clear that raptor pellet analysis is not advocated to the exclusion of other research methods. No single method yet introduced

is absolutely fool-proof—not even that of field observation—nor can we presume that perfection will be achieved in this respect for some time to come. We must use *all* of the most effective methods at our command, checking one against another, if our data are to be of the highest grade.

Pellet analysis might reasonably be the most important of the investigator's approaches in the study of owl food habits; in the study of marsh hawks and falcons (peregrines, at least), it might be employed to excellent advantage in conjunction with observation and nest visits; in the study of Buteos, it probably can be used only slightly, if at all. At any rate, whatever its defects with regard to some species, it certainly has its place in the study of others—particularly in winter studies. In winter, pellets of many raptors are easiest to obtain and are also of the best quality because of the absence of soft juvenile bones at this season. Again, one does not have to shoot or trap interesting and valuable birds to amass voluminous pellet data.

University of Wisconsin, Madison, Wisconsin, August 5, 1930.

CRITICAL NOTES ON SOME YELLOWTHROATS OF
THE PACIFIC SOUTHWEST¹

WITH ONE ILLUSTRATION

By A. J. VAN ROSSEM

The following conclusions, insofar as they relate to the yellowthroats of southern California and southern Arizona, are in close accord with those already published by Grinnell and Swarth. However, a reiteration of the differences between *Geothlypis trichas occidentalis* and *Geothlypis trichas scirpicola* may appropriately be introduced since in some quarters doubt apparently still exists concerning their distinctness. Briefly the differences between the northern and northwestern form *occidentalis* (Brewster, Bull. Nutt. Orn. Club, 8, 1883, p. 159 [Truckee River, Nevada]) and the southern race *scirpico'a* (Grinnell, *Condor*, 3, 1901, p. 65 [El Monte, Los Angeles County, California]) are the brighter coloration and slightly larger bill of the latter. To be more specific; in *scirpicola* the dorsal plumage is greener (less grayish); the yellow of the underparts extends farther over the abdomen and is, in series, definitely brighter; the flanks are more brownish (less grayish); and the post-frontal band of white in the males is wider. Probably most of the doubt surrounding the validity of this resident, sedentary subspecies arises from failure to recognize the fact that the migratory *occidentalis* occurs as a winter visitant and a transient over its entire range. Personal experience leads me to believe that the majority of yellowthroats to be found in southern California, even as late as the middle of May, are migratory *occidentalis* passing through at a time when *scirpicola* has commenced to breed. This is particularly true on the desert side of the mountains.

To the already determined range of *scirpicola* I have a few extensions based on breeding birds. The re-vamped range extends along the Pacific slope from about latitude 30° in Lower California (see Grinnell, *Lower California Ornithology*, 1928, pp. 203-4; also many specimens examined by me in the Natural History Museum) north to Santa Barbara, California, the southern San Joaquin Valley (Buena Vista Lake), and Walker Basin on the south fork of the Kern River (all in the Dickey collection: birds from the last two localities incline toward *occidentalis*). The Colorado River drainage colony which is (apparently) isolated from that on the Pacific extends from the mouth of the Colorado River north along that stream, and its tributary the Virgin River, to Washington, Washington County, Utah (Dickey coll., typical), west through the Imperial Valley (many specimens) to Mecca, Riverside County (Dickey coll.), and east up the Gila and Santa Cruz rivers at least to Tucson, Arizona (Dickey and Nat. Hist. Mus. colls.).

Some years ago Swarth (Univ. Calif. Publ. Zool., 10, 1912, pp. 71-3) in commenting on four breeding birds from the San Pedro River in Cochise County, Arizona, expressed the opinion that they might prove to be separable from *scirpicola*. He has subsequently (Proc. Calif. Acad. Sci., 4th ser., 18, 1929, p. 339) reaffirmed his previous statements. His alternative was to consider them as possibly referable to *Geothlypis trichas melanops* (Baird, Rev. Amer. Birds, 1865, p. 222 [Mexico]) a form known only from the states of Vera Cruz and Oaxaca, and the Valley of Mexico. The Dickey collection has lately acquired a series of yellowthroats from northern and east-central Sonora, Mexico, consisting of eleven breeding birds from Saric and a March specimen from Tecoripa. These prove to be similar to the San

¹ Contribution from the California Institute of Technology, Pasadena.

Pedro River birds (all four of which are at hand) but the color characters are carried to an even greater extreme. By the courtesy of the United States National Museum there is available the type of *melanops* and also two other males of that form (Biological Survey coll.) from the Valley of Mexico. The two latter are surely breeding birds, for they were collected on June 25 and 26. These three specimens are all very much larger than any of the more northerly subspecies, as will be seen from the accompanying table of measurements. They bear, in color, close resemblance to *scirpicola* save that the posterior underparts are continuously yellow and there is more concealed yellow in the crown. The Sonora series constitutes a very distinct race, the brightest colored of all the forms of *Geothlypis trichas*, and for it I propose the name of

Geothlypis trichas chryseola subsp. nov.

Type.—Breeding male adult, no. 28,584, collection of Donald R. Dickey; Saric, north-central Sonora, Mexico; June 12, 1929; collected by J. T. Wright; original number 3557.

Subspecific characters.—Compared with *Geothlypis trichas melanops*, size decidedly smaller and whole plumage lighter and brighter; yellow of underparts more intense; green of upperparts, wings, and tail more yellowish (less olive) green. No females of *melanops* are available for comparison. Compared with *Geothlypis trichas scirpicola*, both sexes are brighter and more yellowish above, the yellow of the underparts is brighter and more extensive (the flanks of the males are only slightly, or not at all, tinged with grayish), and the post-frontal white band in the males is even wider and is noticeably suffused with yellow.

Range.—North-central Sonora, northeast to the San Pedro River in Cochise County, Arizona; east to northwestern Chihuahua and south, in spring at least, to Tecoripa, east-central Sonora.

Remarks.—The Chihuahua specimen mentioned by Ridgway (Bull. U. S. Nat. Mus., 50, pt. 2, 1902, p. 674, footnote) unquestionably belongs here. As for the four previously mentioned birds from the San Pedro River, Arizona, they are so variable that, as a lot, they could go into one race just as unsatisfactorily as into the other. One (no. 2913, Swarth coll.) is close to typical *chryseola*, another (19,116, Mus. Vert. Zool.) is nearest *chryseola*, a third (19,118) is just about intermediate, while the fourth (19,117) is, except for the very wide post-frontal band, closer to *scirpicola*. The preponderance in the small series is certainly closer to *chryseola* and accordingly I have so called them. Mr. Swarth informs me that they were all taken at exactly the same place, about midway between Fairbank and Charleston, on the San Pedro River. Three of the four localities from which the new race is known (Saric, Tecoripa, and San Diego) indicate an upland habitat, and when finally worked out the range will probably be found to center on the northern part of the Mexican plateau.

The breeding yellowthroats of the Arid Tropical Zone in southern Sonora are a variable lot. I have finally concluded that, as a whole, they are best referable to *Geothlypis trichas modesta* (Nelson, Auk, 17, 1900, p. 269 [San Blas, Tepic (= Nayarit), Mexico]), although actually they are a series of variable intergrades between that form and *chryseola*. There are available, from the type locality, three females and a male of this race (Calif. Acad. Sci. coll.) as well as eight males and two females (Dickey and Bancroft collections) from various points in Sonora, from Empalme (near Guaymas) south to Agiabampo on the Sonora-Sinaloa boundary. In typical form, *modesta* is a dark-colored race. It is very much like *Geothlypis trichas sinuosa* of the San Francisco Bay region, but is slightly grayer (less olive) and has a longer tail and decidedly larger bill. However, were it not for the larger bill, a very noticeable feature, it would require pretty fine discrimination to distinguish between these two races even though their respective ranges are separated by a gap of over a thousand miles. In addition to the mainland examples enumerated above, there are two females of *modesta* collected by the writer in southern Lower California. These were taken respectively at Magdalena Bay (North Estero) on March 3, 1930, and on San José Island, in the Gulf, on March 14, 1930. Both were

in a mangrove-salicornia association, the typical habitat of *modesta* on the opposite side of the Gulf. Their presence was, of course, purely fortuitous, and comparable to the sporadic occurrences of other Mniotiltidae such as *Euthlypis lachrymosa tephra* and *Compsothlypis graysoni*. Incidentally, I think it possible that a re-examination of the Brewster collection might produce other Lower California records of *modesta*. This suggestion is based on Brewster's remarks (Birds Cape Region, 1902, p. 186) relative to the possible occurrence of "*sinuosa*" in the Cape Region.

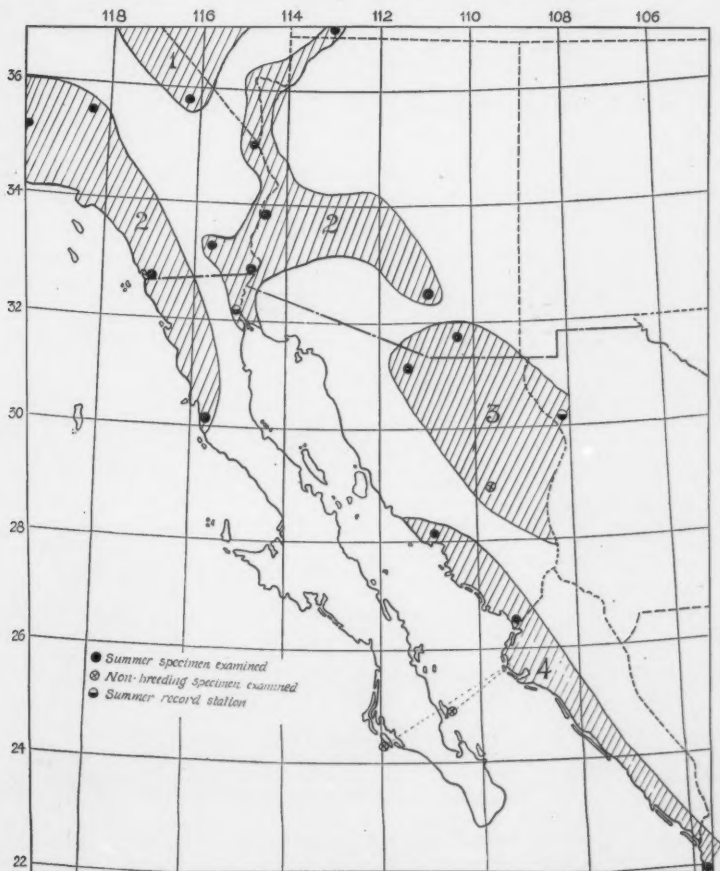


Fig. 111. DISTRIBUTION OF YELLOWTHROATS IN THE PACIFIC SOUTHWEST. RANGES OF THE RACES ARE INDICATED AS FOLLOWS. 1. *occidentalis*. 2. *scirpicola*. 3. *chryseola*. 4. *modesta*.

In arriving at the opinions expressed above I have examined more or less critically, but unfortunately not all at the same time, some 500 yellowthroats. However, as many as 275 have been assembled and directly compared at once. In addition to the 178 in the Dickey collection, specimens have been freely borrowed or notes made from the various public and private collections to whom credit is given

in the text above. On the accompanying map (fig. 111) no effort has been made to "spot in" record stations other than critical ones as a basis for the range outlines drawn.

Average Measurements of Males			
	Wing	Tail	Exposed culmen
20 occidentalis	55.7	52.4	10.7
20 scirpicola	55.6	52.7	11.5
10 chryseola	55.5	53.6	11.7
9 modesta	53.8	52.3	11.7
20 sinuosa	52.6	49.2	10.1
3 melanops	61.7	61.7	12.3

Pasadena, California, August 22, 1930.

FROM FIELD AND STUDY

The White-tailed Kite in Marin County, California.—A note in the *Condor* (XXXI, 1929, p. 36), contributed by E. L. Bickford of Napa, records the breeding of the White-tailed Kite (*Elanus leucurus*) in Napa Valley, California. This stimulates me to remark that during recent years I have several times seen individual kites of this species in Marin County, usually over the marshes bordering the north shore of San Francisco Bay.

The first one noted was hovering over the flat below Mill Valley just east of the school house on the morning of October 11, 1920. About a month later (November 14, 1920) J. Eugene Law saw one on the flat between San Rafael and Point San Quentin. On May 21, 1925, while Dr. F. V. Coville and I were driving north on our way to the Redwood highway we saw one near Ignacio station, seven miles north of San Rafael.

The last kite seen by me was on November 2, 1928, when returning from a field trip by way of Black Point Cut-off. Approaching the Petaluma Creek drawbridge I was delighted to see one of these beautiful kites gracefully circling and darting about over the open meadows. Just before arriving at the draw it dropped to a post close by and remained there while I passed. This is the only time I have seen one alight. Usually they are on the wing.

Mr. Bickford's breeding record is of much interest, being so far as I am aware the first one for many years for the north side of San Francisco Bay.—C. HART MERRIAM, *Lagunitas, California, August 7, 1930.*

House Finches Eating Watermelon.—The house finches (*Carpodacus mexicanus frontalis*) of the San Joaquin Valley are certainly developing a great fondness for watermelon. On July 7 and 8, 1930, I watched them at a feeding station thirty miles north of Bakersfield. During the morning hours, and still more during the afternoon hours, there was a steady stream of these birds to some watermelon rinds for the ripe watermelon pulp still present. Most of these feasting birds were young of the year, but there was also a fair number of both adult males and adult females. At first I thought the birds were attracted because of thirstiness; but soon after that, I noted that pulp that was almost dry was taken as well.—M. P. SKINNER, *Long Beach, California, July 16, 1930.*

The Cardinal in Oregon.—During midday, July 22, 1930, on a field trip in Douglas County, Oregon, a stop was made for lunch along a small mountain stream beside the highway. Much to my surprise, two Cardinals (*Cardinalis cardinalis* subsp.), a male and female, were seen chasing each other through the scattered small trees and bushes bordering the stream. A few moments later, another male was seen up-stream.

These birds were observed at a distance of thirty feet and there is not a shadow of doubt about their being Cardinals; but as to their subspecific identity and as to when and where they came from into the state of Oregon, I have not the slightest idea.—STANLEY G. JEWETT, *Portland, Oregon, August 4, 1930.*

The Common Mynah Breeding in Los Angeles.—Early in July, 1930, Dr. Hildegarde Howard Wylde, of the Los Angeles Museum, received a message from Dr. Calla E. Starbuck, of 1363 Lucile Avenue, Los Angeles, stating that some strange birds had appeared in that neighborhood and had bred there. On July 22 Dr. Wylde and the writer called on Dr. Starbuck and saw one of the birds which proved to be a Common Mynah (*Acridotheres tristis*).

Dr. Starbuck informed us that a pair of the birds had appeared early in May and soon thereafter had built a nest in a drain-pipe near the top of a two-story building across the street from her residence. Three young were raised, one of which was later killed by an automobile. At the time of our visit the birds were apparently nesting a second time. The male was seen to enter the nesting cavity, where it remained for some time before emerging. Also, according to Dr. Starbuck,

a considerable amount of new nesting material had been carried to the cavity after the first brood had been raised.—G. WILLETT, *Los Angeles Museum, Los Angeles, California, July 23, 1930.*

The Asiatic Mynah in Los Angeles, California.—In the present issue of the *Condor*, Mr. George Willett reports the sighting by Dr. Hildegard Howard Wylde and himself of the Common Mynah (*Acridotheres tristis*) in Los Angeles. I was able to call at the locality on the following day in company with Agricultural Commissioner H. J. Ryan, and, by permission of the Police Commission, to secure a specimen of the species, collected by Deputy Neville. This specimen is now no. 56175 of the Museum of Vertebrate Zoology and proves Mr. Willett's diagnosis to be correct.

Commissioner Ryan has devoted great energy to the matter and states that six individuals have thus far been collected and that all reports of other colonies are being followed up with energy. The appeal to the Agricultural Commissioner was made upon the basis of my own three years' contact with the Mynah as naturalized in Hawaii and of the accounts of Dr. Raymond B. Cowles who has had long experience with the species as introduced into South Africa. In both areas the bird is looked upon as a most undesirable alien.

In Hawaii the following charges are laid against him:

Direct attack upon small fruits.

Dispersal of seeds of fruiting shrubs that rendered useless large areas of grazing lands.

Invasion of forest areas to the detriment of native species (though probably these species were doomed anyway).

Obnoxious habits about cities and home grounds.

Add to these charges the possibility of introducing parasites or disease-producing organisms and the danger seems too great to be justified by the pleasure (?) of a new addition to the list of our bird acquaintances.—LOYE MILLER, *University of California at Los Angeles, September 2, 1930.*

The Cassin Auklet Breeding off the Coast of Oregon.—During a trip along the southern Oregon coast, a visit to Island Rock off the Curry County coast near Port Orford was made, to study the sea birds nesting there. This rock is about three miles off-shore and comprises about five acres in area where numbers of California Murre, Cormorants, Western Gull, Tufted Puffin and Beal Petrel, with fewer Forked-tailed Petrels, were found nesting, while the presence of a few pairs of Cassin Auklets (*Ptychoramphus aleuticus*) proved of the utmost interest constituting, as it does, the first positive nesting record of this species off the Oregon coast. One adult breeding bird and two downy young were collected as evidence to substantiate the record.—J. C. BRALY, *Portland, Oregon, July 18, 1930.*

Observations upon Hummingbirds.—On January 4, 1929, while staying at Monte Robles, near Ramona, San Diego County, California, I noticed a single female Anna Hummingbird (*Calypte anna*) flying within a few feet of the ground. As I watched, she flew down and lit in the middle of the path ahead of me. She then seemed to pick something off of the somewhat sandy ground, which had been moistened by a recent rain. Following this, she stuck out her long tongue. She then flew around for a moment but returned within a foot of the same place on the ground. Here again, she went through almost the same motions. On arising the second time she flew off into a grove of near-by oaks. The ground where she had been was examined but it was found quite clean and covered with fine sand.

On March 16, 1929, while in Balboa Park, San Diego, I watched an Anna Hummingbird which lit on some plaster that had been dumped there. While the bird was sitting there it appeared to pick something off the plaster. After remaining there about half a minute it flew away. On examining the plaster closely I could see minute black mite-like creatures running about on its surface.

On July 26, 1930, I observed a pair of Anna Hummingbirds in copulation. When first observed, the birds were playfully chasing each other about and suddenly swooped down to within about eighteen inches of the ground where the leading bird, which

proved to be the female, stopped and faced about. The male approached and the mating was consummated in the air, the birds breast to breast and with the male somewhat under the female. The male then settled down to the ground for a few moments, fanning out his tail and pointing his beak upward, while the female flew to a nearby perch. After a short rest, the male rose and flew after the female who returned to her former position and mating again took place as before. Both acts occurred at a distance of less than ten feet from where I stood so that the actions and positions of the birds were plainly seen.

Search of the literature available to me has failed to reveal any record of hummingbirds feeding from the ground or of their manner of mating.—LEROY W. ARNOLD, San Diego, California, August 9, 1930.

*A Northwestern Race of the Mexican Goshawk.*¹—Until 1921, the Mexican Goshawk stood as a species within which no geographic variation was recognized. In that year, however, Miller and Griscom (Amer. Mus. Novit. no. 25, December 7, 1921, p. 4) separated the Central American race under the name of *Asturina plagiata micrus* and designated as distinguishing characters the smaller size and single complete tail-bar. In the same paper the authors discussed the peculiarities of specimens from northwestern Mexico. More recently Peters has shown (Bull. Mus. Comp. Zool., 69, no. 12, 1929, p. 46) that typical *plagiata* of southeastern Mexico is not a large race, in fact only by a very slight average is it larger than the Central American form, but he considers *micrus* to be distinguishable by this very slightly smaller size, darker ventral coloration and single complete tail-bar. Turning back now to Miller and Griscom's paper it is found that they have included northwestern Mexican specimens in their averages for *plagiata*, and because of this their measurements for that race are very large.

Recently there have come to hand seven goshawks from Sonora which show beyond question that there are three instead of two races of this widely distributed species. Not only are the tail characters mentioned by Miller and Griscom found to hold good, but the size alone is sufficiently greater than *plagiata* to justify the formal separation of these northwestern birds. A brief synopsis of the characters and ranges of the three races follows. I use Peters' measurements for *plagiata*, since he has measured more adult males than I have and his method of measuring the wing is identical with my own, that is, across the chord from carpal joint to the tips of the longest primaries.

Asturina plagiata plagiata Schlegel.

Size small (wings of 6 adult males 241-250 mm.); tail with two complete white bars, with usually traces of a third (in typical *plagiata* the two tail-bars are apparently a very constant feature, as I took pains to verify in 1927); underparts paler, the gray bars narrower and the white interspaces wider. Southeastern Mexico, north into Tamaulipas and (*vide* Peters) south to the Toledo District of British Honduras. I have seen no Texas birds and therefore cannot state positively which form occurs there.

Asturina plagiata micrus Miller and Griscom.

Size small (wings of 9 adult males 235-247 mm.); tail with one complete bar and usually only traces (or none) of a second; underparts slightly darker, the gray bars wider as well as slightly darker and the white interspaces narrower. Southern Central America, north on the Pacific coast to include all of Salvador and north into the extreme northwestern corner of Honduras (Tela, Lancetilla and Progreso: *vide* Peters). The recent ascription of *plagiata* to Salvador (Peters, *ibid.*) on the basis of a single specimen is in error. Twenty-two birds, collected in many localities throughout that country, are for the most part typical *micrus*. Four or five are intermediate toward *plagiata* but only slightly so.

Asturina plagiata maxima, subs. nov.

Type.—Male adult; no. 28,146, collection of Donald R. Dickey; San Javier, Sonora, Mexico; April 9, 1929; collected by J. T. Wright; original no. 2996.

¹ Contribution from the California Institute of Technology, Pasadena.

Size large (wings of 5 adult males 256-274 mm.); tail with one complete bar and an incomplete second one (usually present as an oval spot on central rectrices); underparts as in *plagiata*. Southern Arizona (Fort Lowell), south through Sonora (Seric, San Javier, Magdalena, Chinobampo, Guirocoba) to Sinaloa and probably to Tepic.—A. J. VAN ROSSEM, Pasadena, California, July 31, 1930.

More about the White Pelican on the Texas Coast.—Since writing the little story which appeared in the July issue of the *Condor* regarding the nesting of White Pelicans (*Pelecanus erythrorhynchos*) on the Texas coast, further observations have been made, an account of which may be of interest as supplemental to the original story.

Naturally I was eager to find how the colony was faring this year, and the morning of May 25 found me on my way to North Bird Island. I was not prepared, however, for the thrilling spectacle that awaited us as we landed. The island was literally white with breeding pelicans—acres of them. My estimate of adult birds was five thousand. The friend who accompanied me, and the boatman, insisted that there were twice that number. They were arranged in four major areas and a number of smaller ones, the largest being at the south end of the island as in 1929. The nests were placed near together and were poorly and, apparently, hastily built. The composition was nearly altogether of sticks and weeds with practically no mound of sand and shell, and they were not nearly so large as the average nest of the Brown Pelican. By the way, there were six nests of the latter in the colony. Most of the nests contained one or two eggs. A very few held young apparently two weeks old and other nests contained young newly hatched. The number of dead chicks lying about was large. One lone Caracara was the only scavenger observed.

I was disappointed in being unable to remain on the island for more than two or three hours. Notwithstanding the birds being unusually fearless they were too much disturbed by our presence to permit observation of their feeding habits. Later in the day while on our way to the larger South Bird Island we saw company after company of White Pelicans headed for their nesting colony and I think it fair to assume that some of them were carrying food to their young and others were on their way to relieve their mates in the duties of incubation. Late in the afternoon we were in the same vicinity and saw them leaving the island in precisely the same order as we had seen them approach it.

This pelican, being a surface feeder and not a plunger like his brown cousin, feeds in the shallow inlets of Laguna Madre, teeming with small fish, below South Bird Island. Not one White Pelican was seen north of North Bird Island. The thing that impressed me most was that they were gregarious in their coming and their going from the nesting place. They moved in companies of seventy-five or one hundred, not a great distance over the water, and in lines so uniform as to do credit to a company of West Point cadets. Not half a dozen isolated birds were seen. I might add that not a single White Pelican was on South Bird Island and the brown variety had been reduced to about thirty pairs, the smallest number that has bred there for years. Has the coming of the larger species in such great numbers affected the abundance of the smaller?—J. J. CARROLL, Houston, Texas, August 5, 1930.

Nesting of the California Pigmy Owl in Oregon.—On May 21, 1930, I was hunting birds' nests on the west side of the upper Klamath Marsh near Fort Klamath, Klamath County, Oregon. While passing through a grove of unusually large quaking aspen trees at the edge of the marsh, I noticed an old flicker excavation about twelve feet from the ground in one of the largest aspens. Upon striking this tree, a Pigmy Owl (*Glaucidium gnoma californicum*) flushed, and on examination the nest proved to hold six beautiful white eggs of that species, slightly advanced in incubation. The set with both parent birds was collected and the birds were identified by Stanley G. Jewett in whose collection they now bear numbers 6278 and 6279.—J. C. BRALY, Portland, Oregon, July 18, 1930.

EDITORIAL NOTES AND NEWS

Another popular-style bird book has appeared relative to the birds of Africa—this time restricted to a southern subdivision of that continent. The author, Captain Cecil D. Priest, contributes what impresses us as promising practical help to beginning bird students, done in a workmanlike way. Under the title, "A Guide to the Birds of Southern Rhodesia and a Record of their Nesting Habits," there are presented 233 pages of text together with 14 colored plates and 112 black and white drawings. As is well stated in the "Foreword," what is probably "the most effective method of preserving bird-life is to excite an interest in the study of it." It appears that Captain Priest's work is the first of this sort pertaining to Rhodesia, where heretofore there has been a lamentable disregard of bird-life as an asset of the country worth preserving.

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

JULY.—The July meeting of the Northern Division of the Cooper Ornithological Club was held on July 23, 1930, at 8:00 p. m., in Room 2003, Life Sciences Building, University of California, Berkeley. In the absence of the president and vice-president Mr. Alden Miller presided. Forty-five members and guests were present. Minutes of the Northern Division for May were read and approved. Applications for membership from the minutes of the Southern Division for May were heard.

The secretary read a report of the committee appointed by President Storer to place a memorial tablet in the Hayward Public Library to commemorate the one hundredth anniversary of the birth of James Graham Cooper, upon whose old homesite the library stands. The report was written by Mr. Joseph Mailliard, who stated that the tablet had been duly prepared, bearing the following inscription: "To recall the homesite of James Graham Cooper, M. D., June 19, 1830-July 19, 1902, foremost ornithologist of California. Noted for his book, 'Ornithology of California', issued in 1870. This plaque placed here by the Cooper Ornithological Club".

This tablet was unveiled with appropriate ceremonies on June 19. Mr. Emerson moved that the report of the committee be accepted and that the committee be thanked and discharged. It was so ordered. Mr. Emerson added that he himself had hung a framed photograph of Dr. Cooper, taken in 1879, above the plaque and that he had presented to the Hayward library a hand-colored copy of Dr. Cooper's "Ornithology of California".

Mr. Miller told of his pleasure in becoming acquainted with the Broad-tailed Hummingbird during field work in Nevada, and Mr. Emerson reported the killing of the male of a pair of White-tailed Kites in an orchard near Hayward, the owner mistaking the birds for "hen hawks".

"British Birds in Field and Museum" was the subject of the evening's main talk given by Mr. H. S. Swarth, who explained that his recent trip abroad was undertaken with two objectives—to study bird-skins in the British Museum and at Tring and to attend the Seventh International Ornithological Congress held at Amsterdam during the first week in June. Mr. Swarth's talk covered many other items besides those indicated in his title, some scarcely avian but all most interesting.

Adjourned.—HILDA W. GRINNELL, Secretary.

AUGUST.—The August meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday evening, August 23, 1930, at 8:00 p. m., in Room 2003, Life Sciences Building, University of California, Berkeley, with forty-five members and guests present and President Storer in the Chair. Minutes of the Northern Division for July were read and approved. The following applications for membership were read: Dean Blanchard, Hotel Durant, Berkeley, California, sponsored by Dr. Evermann and Mr. Swarth; Richard N. Lewis, Inverness, Marin County, California, sponsored by Mr. Clinton G. Abbott.

Mr. Grinnell announced that the printer is at work upon Avifauna number 20, the ten-year index to the *Condor*, prepared by Mr. George Willett. Mr. B. C. Cain reported noting, as of especial interest

on his summer's outing, Pine Grosbeaks on the Tioga Road and a pair of the same species near Laurel Lake, on July 18; Piñon Jays at 6000 feet altitude near Carson City, Nevada; and being startled by the yelping of a Spotted Owl traced and seen at his camp near Iowa Hill. Attention was called by him to the new magazine "Western Nature Study," published at the State Teachers College, San Jose. Mr. Cain alluded further to a statement made in this publication that herons "spear" their prey and asked if anyone present had seen an instance of this, as he himself had only seen the bill used as a forceps in the tactics of the heron. No one corroborated the magazine statement.

Miss Selma Werner reported a walk taken in Yosemite Valley on August 2, in company with Mr. Michael, in which the high lights were the sight of a Great Horned Owl being mobbed by a bevy of small birds, and a young Hermit Warbler taking six successive baths. Mrs. Allen told of an abundance of birds seen on a quiet evening in early June at the marshy end of Donner Lake. Gordon Bolander contributed a note upon a nighthawk seen at an evening baseball game in Oakland, and Leslie Hawkins told of studying Black Swifts near Santa Cruz and of hearing their metallic calls. He also presented the largest bird census of the evening, having listed forty-two species and approximately 2000 individuals during a four-hour walk along the Santa Cruz coast.

Mr. Woodbury told of the results of investigating bird commotions in Zion National Park. Dr. Evermann announced the temporary leasing by the State Division of Fish and Game of an 18,000-acre Game Sanctuary in adjoining parts of Yolo, Colusa and Napa counties. Mr. McCabe spoke of the abnormally cold, wet summer weather this year in central British Columbia and the accompanying scarcity of birds. As the season's best record he mentioned a Bay-breasted Warbler taken by Mrs. McCabe, the first, he thought, for that region. Mr. Swarth brought over from the California Academy of Sciences a beautiful specimen of an Asiatic Partridge, the only museum example of the species, insofar as he knew, outside of the Leyden Museum where the type was placed many years ago. He said that eight of the live birds were brought to San Francisco by a ship boy who stated

that he purchased them in a Manila market. The seven surviving birds were bought by the Jordan Game Farm at Woodland. Miss Barbara Norris told of seeing an American Egret perched in a yellow pine tree. Daniel Axelrod reported having seen young and adult Audubon Warblers at Lokoya, Napa County, on June 22.

The enjoyment of the evening's program of vacation observations was enlivened by Dr. Storer's felicitous services as chairman.

Adjourned.—HILDA W. GRINNELL, *Secretary*.

SOUTHERN DIVISION

JUNE.—On Tuesday evening, June 24, 1930, the Southern Division of the Cooper Ornithological Club held its regular monthly meeting at the Los Angeles Museum, Exposition Park, Los Angeles, with about sixty members and friends present and Vice-President Pemberton in the chair. The minutes of the May meeting of the Southern Division were read and approved. The minutes of the May meeting of the Northern Division were read.

Mr. Wright Pierce spoke of the pleasure derived by those who attended the Annual meeting from the beautiful collection of bird paintings by John Ridgway and also of how they were enjoyed by those who attended the Southern Division meeting next following the Annual meeting. He moved that the Cooper Club extend its thanks and appreciation to Mr. Ridgway for assembling this collection of his works for those occasions. The motion was unanimously adopted.

Mr. Pemberton told of the English Sparrows gathering around the radiator of his car when parked on a street in Bakersfield, but waiting until it had cooled somewhat before attempting to eat the insects that were collected on it. Mr. Reis told of a recent trip to the northwest where he saw D. E. Brown and Jack Bowles, both of whom wished to be remembered to members of the Club.

Mr. J. R. Pemberton was the speaker of the evening. He showed several reels of motion pictures taken on a recent trip to the islands along the west coast of Lower California. He accompanied these pictures with interesting comments on the islands, the animals and the birds being thrown on the screen.

Adjourned.—HAROLD MICHENER, *Secretary*.

INDEX TO VOLUME XXXII

- A
- Abbott, Clinton G., California spotted owl in San Diego County, California, 121; wire-perching woodpeckers, 129; owl voices, 258
- Acanthis linaria, 135
linaria linaria, 216
- Accipiter cooperii, 84, 86
velox, 84, 212
- Accipitridae, 82, 83, 87, 152
- Acridotheres tristis, 301, 302
- Actitis hypoleucos, 98
- AEthiopsar cristatellus, 100
- Aechmophorus occidentalis, 117
- Agelaius phoeniceus, 162
phoeniceus arctolegus, 161
phoeniceus costaricensis, 162
phoeniceus grinnelli, 162
phoeniceus megapotamus, 162
phoeniceus nevadensis, 67
phoeniceus sonoriensis, 162
- Ajaia ajaja, 84
- Alauda wattersi, 100
- Albatross, 116, 273
Short-tailed, 117
Yellow-nosed, 117
- Alcedo bengalensis, 99
- Allen, Amelia S., The construction of a Hutton vireo's nest, 240
- Allen, Walter I., Do gray squirrels destroy eggs or young birds?, 262
- Amandava amandava, 100
- Amaurornis, 90
- Amphispiza belli cinerea, 36
bilineata deserticola, 36
- Anas luzonica, 99
platyrhynchos, 117
- Anseriformes, 13, 81, 82, 83
- Anthus cervinus, 100
gustavi, 99
- A. O. U., annual meeting, 266
- Aphelocoma, 83, 84
californica, 50
californica hypoleuca, 33
- Aphriza virgata, 72
- Aquila chrysaetos, 66, 84, 87, 121
- Arnold, Leroy W., observations upon hummingbirds, 302
- Archaeopteryx, 13
- Archilochus alexandri, 215
- Ardea herodias, 84
- Ardetta cinnamomea, 159
- Arenaria interpres oahuensis, 72
- Arnold, Leroy W., and Frank F. Gander, utilization by birds of water in hollow trees, 165
- Artamus, 94
- Asio wilsonianus, 258
- Astragalinus psaltria hesperophilus, 126
- Astur atricapillus striatulus, 135
- Asturina plagiata maxima, 303
plagiata micrus, 303
plagiata plagiata, 303
- Asyndesmus lewisi, 66, 83, 84, 263
- Auklet, Cassin, 302
Rhinoceros, 117
- Auriparus flaviceps lamprocephalus, 46
- Avocet, 219
- B
- Baeolophus inornatus, 50
- Bailey, Alfred M., Russell W. Hendee, 147; the dotterel and other birds from Cape Prince of Wales, 161; the pintails of northwestern Alaska, 264
- Balanosphyra, 83
formicivora bairdi, 129, 214
- Bancroft, Griffing, the breeding birds of central Lower California, 20; eggs of Xantus and Craveri murrelets, 247
- Basilinna xantusii, 31
- Bassett, Frank N., cedar waxwings visit city business district, 214
- Bee-eater, 96
- Benson, Seth B., and Alden H. Miller, the summer resident birds of the boreal and transition life-zones of Mount Pinos, California, 101
- Berlioz, J., a new hummingbird hybrid, Calypte anna × Stellula calliope, 215
- Bittern, cinnamon, 99, 159
Least, 64
Western Least, 24
- Blackbird, 54, 72
Brewer, 51, 54, 144, 145, 211
Nevada Red-winged, 67
Red-winged, 54, 142, 161, 162
- Blaisdell, Sr., Frank E., behavior of sea gulls during a hail storm, 214
- Bluebird, 70, 173, 232
- Bobolink, 124
- Bob-white, 17, 153
Panama, 73
- Bolander, L. Ph., is the Lewis woodpecker a regular breeder in the San Francisco region?, 263
- Polander, L. Ph., and Charles A. Bryant, some notes on Point Reyes birds, 70
- Bombycilla cedrorum, 64, 214
- Booby, 12
Blue-footed, 160
Brown, 159

- Botaurus lentiginosus*, 84
 Bowles, J. Hooper, and F. R. Decker, the ravens of the state of Washington, 192
Brachyramphus marmoratus, 123
 Braly, J. C., the Cassin auklet breeding off the coast of Oregon, 302; nesting of the California pigmy owl in Oregon, 304
Branta canadensis, 118, 208
 canadensis canadensis, 208
 canadensis minima, 208
 dickeyi, 208
 esmeralda, 208
 howardae, 208
 minuscula, 208
 propinqua, 208
 Brooks, Allan, in memoriam: Charles deB. Green, 9; a gull with feathered feet, 64; the specialized feathers of the sage hen, 205
 Bryant, Charles A., and L. Ph. Bolander, some notes on Point Reyes birds, 70
 Bryant, Harold Child, outdoor heritage, review of, 134
Bubo virginianus, 84
 virginianus elachistus, 27
 virginianus pacificus, 290
 virginianus pallescens, 124, 126, 159
Bubulcus, 97
Bulbul, 92
 guava, 99
 Bunnell, Sterling, aeronautics of bird flight, 270
Bushlark, 100
Bush-tit, 51, 57, 142
 Coast, 172
 Lead-colored, 72, 172
Buteo, 84, 238
 abbreviatus, 27
 borealis, 83, 84
 borealis calurus, 27, 64, 135, 259, 260
 borealis harlani, 135, 259, 260
 cooperi, 259, 260
 lineatus, 83
 regalis, 83
 swainsoni, 84, 86, 127
Butorides virescens anthonyi, 124
 virescens frazari, 24
Buzzard, Bat-eating, 166
 Turkey, 271
- C
- Cacatoes haematuropygia*, 99
Calidris canutus, 72
Calliope calliope, 99
Calypte anna, 215, 302
 costae, 29, 215
Canachites, 153
 canadensis, 152, 153
Capella gallinago, 164
 megala, 98, 164
 stenura, 164
Caracara Audubon, 27
Cardellina rubrifrons, 128
Cardinal, 301
 San Lucas, 38
Cardinalis cardinalis, 301
Carpodacus cassinii, 103
 mexicanus, 262
 mexicanus frontalis, 121, 301
 mexicanus ruberrimus, 35
 Carroll, J. J., breeding of the American white pelican on the Texas coast, 202; more about the white pelican on the Texas coast, 304
Catbird, 124
Cathartes aura, 84
 aura septentrionalis, 27, 159
Cathartidae, 82, 83, 87
Cathartornis gracilis, 84, 87
Catherpes mexicanus punctulatus, 46
Centrocercus urophasianus, 205
Centropus javanicus, 99
 viridis, 99
Centurus uropygialis brewsteri, 28
Cephus columba, 253
 grylle, 253
Certhia familiaris zelotes, 103
Chalcophaps, 92
 indica, 98
Chalcostigma herrani, 74
Chamaea fasciata henschawi, 50
Chamaepelia passerina pallescens, 26
Charadriiformes, 13, 81, 82, 83, 86
Charadrius dubius, 98
Chat, Long-tailed, 56, 131
 Long-tailed Yellow-breasted, 42
Chen hyperboreus, 118
 hyperboreus hyperboreus, 66
Chendytes, 118
 lawi, 116, 117
Chickadee, Carolina, 165
 Chestnut-backed, 51, 69
 Mountain, 57
Chicken, Wild, 92
Chordeiles acutipennis inferior, 29
 virginianus hesperis, 103
Ciconia, 84
Ciconiidae, 82
Ciconiiformes, 13, 81, 83
Cinnyris, 97
Circus hudsonius, 84
 melanoleucus, 99
 spilonotus, 99
Clabaugh, Ernest D., methods of trapping birds, 53
 Clark, Harold W., notes on the avifauna of a transition island in Napa County, California, 50; olives as food for robins and other birds, 163

- Clary, Mrs. Ben L., blue-footed booby on
Salton Sea, 160
- Cockatoo, 99
- Cock, Wild, 92, 93
- Colasisi, 99
- Colaptes, 125
cafer, 84
cafer collaris, 51, 70
chrysoides chrysoides, 28
- Coletto, 100
- Colinus cristatus, 73
sonnini, 73
leucopogon hypoleucus, 73
leucopogon leucopogon, 73
leucopogon leylandi, 73
leucotis leucotis, 73
leucotis panamensis, 73
- Columba fasciata, 72, 84
- Columbidae, 27
- Columbiformes, 13, 81, 83
- Colymbiformes, 13, 81, 83
- Colymbus, 84
dominicus brachypterus, 23
- Compsothlypis graysoni, 299
- Condor, California, 106
Pleistocene, 87
- Cooper Ornithological Club, regular meet-
ings, minutes of, 74, 135, 169, 219,
267; directory of members of, 175;
fifth annual meeting, minutes of,
172, 218
- Cooper, J. G., a tablet to, 219, 220
- Coot, 97, 144
North American, 24
- Coragyps occidentalis, 84, 86, 87
urubu, 86, 87
- Cormorant, 12, 116, 302
Baird, 70
Farallon, 70
- Corthylio calendula cineraceus, 102, 103
- Corvus brachyrhynchos, 84
brachyrhynchos hesperis, 67
corax sinuatus, 35, 192
principalis, 192, 193
- Corvidae, 82, 83
- Coucal, Javan, 99
Red-winged, 99
- Cowbird, 126, 268
Dwarf, 126, 130
Nevada, 67, 124
- Cracidae, 153
- Crake, Ashy, 98
Banded, 98
Lead-colored, 98
Ruddy, 98
- Crane, 10, 12, 38, 83, 86
Little Brown, 5, 62, 63, 265
Sandhill, 7, 62
- Creciscus jamaicensis coturniculus, 211
- Crossbill, 54, 96, 173
Red, 216
White-winged, 216
- Crow, 92, 140, 207
Western, 67
- Cryptoglaux, 102
acadica, 101, 212
- Cuckoo, 83
- Cuculiformes, 13, 81, 83
- Cuncuma, 90, 94
leucogaster, 159
- Cupido, 206
- Curlew, 96
Hudsonian, 22
Pigmy, 98
- Cyanocitta stelleri frontalis, 51, 103
- Cyrtostomus jugularis, 99
- D
- Dafila acuta, 58, 99
acuta acuta, 265
acuta tzitzihua, 265
- Decker, F. R., and J. Hooper Bowles, the
ravens of the state of Washington,
192
- De Fremery, Herman, valley quail and
sharp-shinned hawk, 211
- Dendragapus, 206, 207
obscurus howardi, 103
- Dendrocygna arcuata, 99
- Dendroica aestiva, 119, 137
auduboni auduboni, 51, 103
coronata, 135
coronata hooveri, 103
erithachorides castaneiceps, 42
- Dendrophassa axillaris, 98
vernans, 98
- Diatrymiformes, 13
- Dicaeum, 97
papuense, 99
pygmaeum, 99
- Dickey, Donald R., and A. J. van Rossem,
a new bluebird from El Salvador,
69; the identity of Ortyx leuco-
pogon Lesson, 72
- Dixon, Joseph, the wood ibis in Yellow-
stone National Park, 288
- Diomedea, 117
exulans, 117
nigripes, 117
- Dolichonyx oryzivorus, 124
- Dotterel, European, 161
- Dove, 89, 92
Barred Ground, 98
Bleeding-heart, 98
Blood-breasted, 98
Bronze-winged, 98
Mexican Ground, 26
Mourning, 53, 86, 144
Red Turtle, 98
Slender-billed Cuckoo, 98
Turtle, 98
Western Mourning, 25
Western White-winged, 26

- Dowitcher, 22, 219
 Long-billed, 165
- Dryobates scalaris, 28
 scalaris lucasianus, 28
 villosus hyloscopus, 51
 villosus monticola, 66
- Duck, 10, 86, 97, 105, 118
 Fulvous Tree, 204
 Lesser Scaup, 22
 Mallard, 199, 267
 Pacific Harlequin, 128
 Pintail, 58, 161, 264
 Scaup, 161
 Tree, 99
 Tufted, 99
 Wild, 89
 Wood, 76, 171
- Dumetella carolinensis, 124
- E
- Eagle, 15, 83, 87, 90, 118
 Bald, 106, 116, 117, 157, 158, 173
 Golden, 66, 87, 106, 121, 135, 172
 Sea, 94
 White-breasted Sea, 159
- Edson, J. M., recession in weight of nest-
 ling birds, 137
- Egret, American, 117, 219, 220, 267, 306
 Cattle, 97
- Elanus leucurus, 70, 84, 301
 leucurus majusculus, 221
- Empidonax difficilis, 51
 wrightii, 101, 103
- Endomyschura, 254
- Eopteryx mississippiensis, 13
- Eremophila alpestris arctica, 161
- Erimyschura, 118
 jamaicensis, 22
- Errington, Paul L., the pellet analysis
 method of raptor food habits study,
 292
- Eudromias morinellus, 161
- Euphagus cyanocephalus, 51, 211
- Eupsychortyx leucopogon, 73
- Euthlypis lachrymosa tephra, 299
- Excalfactoria, 90, 96
 lineata, 97
- F
- Falco columbarius, 84, 86
 mexicanus, 27, 84
 peregrinus, 84
 peregrinus anatum, 27
 rusticolus, 66
 sparverius, 84, 86, 212
 sparverius peninsularis, 27
- Falcon, Peale, 10
 Prairie, 27, 106, 158, 171, 200, 220
- Falconidae, 82
- Falconiformes, 13, 81, 83, 85, 88
- Finch, 219, 286
 Gray-crowned rosy, 54
- Hepburn rosy, 54
- House, 46, 262, 301
- Purple, 54
- Rosy, 54
- Fleming, J. H., chestnut-backed chickadee
 in Lake County, California, 69
- Flicker, 125
 Gilded, 210
 Golden-shafted, 171
 Hybrid, 120
 Red-shafted, 61, 66, 75, 125, 143, 144,
 171
 San Fernando Gilded, 29
 San Lucas Gilded, 28, 29
- Florida caerulea, 83, 84
- Flowerpecker, 97
 Philippine, 99
 Pigmy, 99
- Flycatcher, Lower California Ash-
 throated, 31
 Mexican Vermilion, 31
 Olive-sided, 51, 135
 Traill, 131
 Vermilion, 121, 210, 220
 Western, 51, 75
 Wright, 101
- Fratercula corniculata, 123
- Fulica americana americana, 124
- G
- Gallicolumba, 92, 94
 luzonica, 98
- Galliformes, 13, 81, 83
- Gallinula, 90
 chloropus, 98
 galeata, 210
- Gallinule, Florida, 210
 Giant, 97, 98
- Gallus, 92
- Gander, Frank F., notes on winter bird
 roosts, 64; a black rail leaves the
 salt marsh, 211
- Gander, Frank F., and Leroy W. Arnold,
 utilization by birds of water in
 hollow trees, 165
- Gardner, Leon L., some observations on
 erythrocyte count in birds, 158;
 whistling of snipe, 164; Filipino
 cock fighting, 242
- Gardner, Leon L., and Richard C. Mc-
 Gregor, Philippine bird traps, 89
- Gavia stellata, 261
 viridularis, 161
- Gaviiformes, 13
- Geocichla, 92
- Geococcyx, 86
 californianus, 27, 84
- Geopelia striata, 98
- Geothlypis beldingi goldmani, 42
 trichas, 42
 trichas chryseola, 298

- trichas melanops*, 297
trichas modesta, 298
trichas occidentalis, 217, 297
trichas scirpicola, 297
trichas sinuosa, 298
Geranoaëtus fragilis, 84, 86
 grinnelli, 84
Glareola orientalis, 99
Glaucidium gnoma, 84
 gnoma californicum, 304
 gnoma grinnelli, 51
Gnatcatcher, Black-tailed, 126
 Santa Margarita Black-tailed, 48
 Western, 131, 171
Godwit, 96
 Pacific, 98, 126
Golden-eye, 161
Goldfinch, Green-backed, 55, 126, 144
 Green-backed Arkansas, 36
 Lawrence, 64
 Willow, 55, 131
Goose, 10, 105
 Emperor, 171
 Indian Dwarf, 99
 Lesser Snow, 66
 Snow, 265
 White-cheeked, 173
Goshawk, 135, 158
 Mexican, 303
Grebe, 97, 157
 Mexican, 23, 76
 Northern pied-billed, 23
 Pied-billed, 261
 Short-winged Santo Domingo, 23
 Western, 116
Green, Charles deB., in memoriam, 9
Grinnell, Dr. Joseph, election as president of A. O. U., 75
Grinnell, J., reviews of McAtee on Naturalizing game birds, 133; Laing and Taverner on birds of the Mount Logan District, Alaska, 134; Bates on the birds of West Africa, 166; the status of the Cooper Henhawk, 259
Grosbeak, Black-headed, 51, 144, 262
 Evening, 54, 68, 220
 Pine, 54, 306
 Rocky Mountain Pine, 262
Grouse, 103, 153
 Dusky, 10
 Ruffed, 10
 Sharp-tailed, 10
 Sooty, 173, 220
 Willow, 157
Gruiformes, 13, 81, 83
Grus americana, 84
 canadensis, 3, 62, 84
 nannodes, 62, 63
 pratensis, 63
Guillemot, Pigeon, 253
Gull, 12, 117, 271
 California, 144
 Glaucous, 65
 Glaucous-winged, 170
 Herring, 65
 Western, 71, 302
Gymnogyps californianus, 84, 87
Gyr Falcon, 66

H

Haematopodidae, 153
Haematopus palliatus, 153
Haliaeëtus leucocephalus, 84, 87, 118
Haliastur, 90
 intermedius, 159
Halcyon chloris, 99
 gularis, 99
Hanaford, A. W., notice of death of, 170
Hanna, Wilson C., notes on the golden eagle in southern California, 121; breeding record of Pacific godwit, 126; southerly breeding record of sage thrasher in California, 263
Hawk, 13, 83, 271
 American Duck, 27
 Asiatic Marsh, 99
 Broad-winged, 18, 19
 Cooper, 18, 292
 Desert Sparrow, 239
 Duck, 18, 106, 158, 171, 272
 Ferruginous Rough-leg, 200, 259
 Harris, 210, 220
 Harris One-banded, 27
 Marsh, 15, 16, 17, 18, 99, 223, 230, 238, 292, 293
 Pigeon, 76, 171
 Red-bellied, 106, 230
 Red-shouldered, 18, 19, 292, 293
 Red-tailed, 18, 135, 223, 230, 239, 267, 292, 293
 San Lucas Sparrow, 27
 Sharp-shinned, 18, 53, 170, 211
 Sparrow, 19, 143, 212, 232
 Swainson, 19, 127, 230
 Western Red-tailed, 27, 64, 135, 144
 Zone-tailed, 27
Heleodytes brunneicapillus affinis, 45
 brunneicapillus brunneicapillus, 46
 brunneicapillus bryanti, 46
 brunneicapillus couesi, 46
Hendee, Russell W., biography of, 147
Hen, Heath, 15
 Sage, 205, 207
 Water, 90
Henhawk, Cooper, 259
Heron, Anthony Green, 24, 75, 124
 Black-crowned Night, 64, 268
 Eastern Green, 24
 Frazar Green, 24
 Great Blue, 86
 Night, 99, 159

- Hesperornithiformes, 13
Hirundo javanica, 94, 99
Histrionicus histrionicus pacificus, 128, 135
 Honey-guide, Black-throated, 166
 Howard, Hildegard, an abnormal wing development in a pintail duck, 58; a census of the Pleistocene birds of Rancho La Brea from the collections of the Los Angeles Museum, 81
 Howell, A. Brazier, more about hawks, 157
 Hubricht, Russell, notice of death of, 220
 Huey, Laurence M., notes on the habits and plumage of young Kaeding petrels, 68; notes from the vicinity of San Francisco Mountain, Arizona, 128
 Hummingbird, 275
 Allen, 51, 214
 Anna, 213, 302
 Costa, 29
 Xantus, 31
Hydranassa tricolor, 83
Hylocichla guttata sequoiensis, 101, 103
 minima aliciae, 217
 ustulata, 135
 ustulata almae, 135
Hypotaenidia philippensis, 90, 98
 striata, 98
 torquata, 98
Hypsipetes, 90
 fugensis, 89

I

- Ibis, 83
 White-faced Glossy, 86
 Wood, 288
Ichthyornithiformes, 13
Icteria virens longicauda, 42
Icterus bullockii, 67, 212
 cucullatus nelsoni, 130
 cucullatus trochiloides, 35
Ixobrychus, 90
 cinnamomeus, 99
 exilis, 64
 exilis hesperis, 24

J

- Jabiru, 84
 Jay, Belding, 34
 Black-headed, 54
 Blue, 17
 Blue-fronted, 51, 53
 California, 50, 53, 142
 Grinnell, 34
 Long-crested, 53
 Piñon, 306
 Rocky Mountain, 53, 54
 Steller, 163
 Woodhouse, 53

- Xantus, 33, 34
 Xantus California, 33
 Jencks, Marshall, saw-whet owls in Oakland, California, 212
 Jewett, Stanley G., an extension of the range of the band-tailed pigeon and of the lead-colored bush-tit in Oregon, 72; notes on the Dowell bird collection, 124; a second nesting record of the Pacific harlequin duck in Oregon, 128
 Junco, 76, 163, 167
 Point Pinos, 55
 Sierra, 55
 Shufeldt, 55
 Thurber, 55, 211
Junco hyemalis thurberi, 211
 oreganus thurberi, 103

K

- Kelso, Leon, some night observations on the western horned owl, 126
 Killdeer, 75, 76, 144, 145
 Northern, 25
 Kingbird, Western, 143, 144, 145
 Kingfisher, White-collared, 99
 White-throated, 99
 Kinglet, 57, 103
 Golden-crowned, 102
 Western Golden-crowned, 102
 Western Ruby-crowned, 102
 Kite, Malayan Brahminy, 159
 White-tailed, 70, 106, 221-239, 267, 268, 301
 Kittiwake, 173
 Kluegel, Mrs. Edward A., bequest of, 166
 Knot, 72, 96

L

- Lamprocorax panayensis*, 100
Lanius borealis, 68, 163
 borealis invictus, 135, 163
 excubitorides, 155
 excubitor borealis, 164
 excubitor excubitor, 163
 excubitor invictus, 164
 excubitor mollis, 163
 ludovicianus, 155, 165
 ludovicianus grinnelli, 155
 ludovicianus mexicanus, 155
 ludovicianus migrans, 155
 ludovicianus nelsoni, 42
 ludovicianus nevadensis, 156
 ludovicianus sonoriensis, 155
Laopteryx priscus, 13
Laornis edwardsianus, 13
 Lark, California Horned, 144, 159
 Horned, 66, 67, 145
 Magdalena Horned, 33
 Merrill Horned, 161

- Pallid Horned, 161
 Saskatchewan Horned, 162
Larus argentatus smithsonianus, 65
glaucescens, 65, 117
hyperboreus, 65
occidentalis, 71
 Law, J. Eugene, watermelon as warbler food, 119; review of Lincoln and Baldwin's manual for bird banders, 168
Leptocoma sperata, 99
Leucosticte tephrocotis dawsoni, 103
Leucotreron leclancheri, 98
Limnobaenus fuscus, 98
Limnodromus griseus scolopaceus, 22, 165
Limosa baueri, 98
lapponica baueri, 126
 Linnet, 54, 144, 145
 California, 121
 San Lucas, 35
 Linsdale, Jean M., problems of bird conservation in California, 105; review of Bryant's outdoor heritage, 134
 Longspur, Alaska, 55
 Loon, 116
 Green-throated, 161
 Red-throated, 11, 261
 Lophortyx, 83, 84, 85, 86
 californica, 118
 californica achrustera, 25
 californica californica, 211
 californica vallicola, 51
 Loriculus, 97
 philippensis, 99
 Loxia, 96
 curvirostra bendirei, 103, 216
 leucoptera, 216
- M
- Macropygia tenuirostris*, 98
 Magpie, 72, 126, 207
 Black-billed, 76
 Yellow-billed, 107
 Mailliard, Joseph., happenings in a robin household, 77; western robin eating ivy berries, 210
 Mailliard prize in ornithology, 132, 174
 Mallard, 199, 267
 Luzon, 99
Mareca penelope, 65
Marila affinis, 22
 fuligula, 99
 Martin, H. T., and A. Wetmore, a fossil crane from the pliocene of Kansas, 62
 Martin, Lower California Purple, 40
 Purple, 161
 McAtee, W. L., and Herbert L. Stoddard, American raptors and the study of their economic status, 15
 McCabe, T. T., review of Bernhard Rensch on race-groups and the origin of species, 168; review of Edmund Selous on realities of bird life, 218
 McGregor, Richard C., and Leon L. Gardner, Philippine bird traps, 89
 McLean, Donald D., spring observations on cranes in Fresno County, California, 3
 Meadowlark, 116, 145
 Western, 144, 233
 Meadows, Don, bird notes from Santa Catalina Island, 211
Megalurus, 94
Meleagridae, 82, 83, 87
Melopelia asiatica mearnsi, 26
Melospiza lincolni lincolni, 103
 melodia cooperi, 36
 melodia morphna, 217
 melodia rivularis, 36
 Merganser, American, 171
 Red-breasted, 261
Mergus serrator, 261
 Merriam, C. Hart, the white-tailed kite in Marin County, California, 301
Mesoscolopax minutus, 98
Metallura primolina, 74
 Michael, Charles W., prodigious drillings of a Williamson sapsucker, 119
 Michener, Harold, hawks unwelcome visitors at banding stations, 212
 Miller, Alden H., two new races of the loggerhead shrike from western North America, 155; the status of *Lanius borealis* as a species, 163; review of William Rowan's experiments in bird migration, 166
 Miller, Alden H., and Seth B. Benson, the summer resident birds of the boreal and transition life-zones of Mount Pinos, California, 101
 Miller, Alden H., and Loye Miller, a record of the scarlet tanager for California, 217
 Miller, Loye, further bird remains from the upper San Pedro Pleistocene, 116; a fossil goose from the Ricardo Pliocene, 208; further notes on the Harris hawk, 210; the territorial concept in the horned owl, 290; the Asiatic mynah in Los Angeles, California, 302
 Miller, Loye, and Alden H. Miller, a record of the scarlet tanager for California, 217
Mimus polyglottos leucopterus, 43, 129
Mirafra philippinensis, 100
 Mockingbird, 129
 Western, 43, 56, 144
Molothrus ater, 126
 ater artemisiae, 67, 124
 Moorhen, 98

- Morphnus woodwardi*, 84
 Mud-hen, 279
Munia, 94, 96
 cabanisi, 100
 everetti, 100
 jagori, 100
 Munro, J. A., miscellaneous notes on some
 British Columbia birds, 65; water
 fowl and sculpins, 261
 Murre, California, 71, 302
 Murrelet, Ancient, 253
 Craveri, 247-254
 Marbled, 10, 11, 123
 Xantus, 247-254
Myadestes townsendi, 102, 103
Mycteria americana, 82, 83, 84, 288
Myiarchus cinerascens cinerascens, 31
 cinerascens pertinax, 31
 Myna, 100
 Mynah, Asiatic, 302
 Common, 301
- N
- Neogyps errans*, 84
Neophrontops, 86
 americanus, 84
Nettapus coromandelianus, 99
Nettion, 117
 crecca, 99
 Nighthawk, San Lucas Sharp-winged, 29
 Texas, 144
Nucifraga columbiana, 103
Numenius variegatus, 98
 Nutcracker, 54
 Nuthatch, Pigmy, 51, 56, 103, 104
 Red-breasted, 56, 101, 103, 268
Nuttallornis borealis, 51
 mesoleucus majorinus, 103
Nycticorax nycticorax, 84, 99, 159
 nycticorax naevius, 64
Nyroca marila nearctica, 161
- O
- Oberholseria chlorura*, 103
Oceanodroma leucorhoa kaedingi, 68
 socorroensis, 69
Oenopopelia humilis, 98
Oidemia, 118
 deglandi dixonii, 135
 perspicillata, 117
Oreortyx picta, 51
Oriole, 100
 Arizona Hooded, 35, 54, 130, 131, 144,
 268
 Bullock, 54, 67, 173, 212, 268
 San Lucas Hooded, 35
Oriolus acrorhynchus, 100
 Ornithological Congress, seventh interna-
 tional, 266
Oroscoptes montanus, 263
Ortalis, 153
- Ortyx leucopogon*, 72, 73
 Osprey, 106, 172
Otocoris alpestris, 66
 alpestris actia, 159
 alpestris arctica, 67
 alpestris enertera, 33
 alpestris enthymia, 162
 alpestris hoyti, 67
 alpestris merrilli, 67, 162
Otus asio, 84, 258
 asio bendirei, 51
 asio quercinus, 258
 asio xantusi, 27
 flammeolus flammeolus, 103
 Owl, 12, 13
 American Barn, 27
 Arizona Spotted, 128
 Barn, 83, 144, 233, 234, 238, 258
 Barred, 292, 293
 Burrowing, 19, 144, 145, 258
 California Coast Screech, 51
 California Pigmy, 304
 California Spotted, 121
 Coast Pigmy, 51
 Dwarf Horned, 27
 Elf, 76, 210
 Great Horned, 76, 290, 292, 306
 Horned, 10, 124, 200, 258, 289, 290
 Long-eared, 258, 292, 293
 Northern Spotted, 124
 Pigmy, 290
 Saw-whet, 101, 212
 Screech, 19, 142
 Snowy, 170
 Spotted, 290, 306
 Southern California Screech, 258
 Western Horned, 124, 126
 Xantus Screech, 27
Oxyechus vociferus vociferus, 25
 Oyster-catcher, 218
- P
- Padda*, 96
 oryzivora, 100
Pagolla wilsonia beldingi, 25
Palaealektoris, 153
 incertus, 152
Parabuteo unicinctus harrisi, 27, 210
Paractornis perpusillus, 153
Parapavo, 83, 84, 85, 86, 87
Parrakeet, 89, 97
 Hanging, 99
 Parrot, Green, 99
 Partridge, Asiatic, 306
 Spruce, 153
Passer domesticus, 36, 137
 montanus, 159
Passerculus rostratus rostratus, 160
Passerella iliaca stephensi, 103
Passeriformes, 13, 81, 82, 83

- Pedioecetes, 206, 207
 Pelecaniformes, 13
 Pelecanus erythrorhynchos, 65, 202, 304
 Pelican, 12, 270
 American White, 202
 Brown, 203
 White, 65, 111, 203, 204, 304
 Penguin, 286
 Penthestes carolinensis, 165
 gambeli baileyi, 103
 rufescens rufescens, 51, 69
 Percididae, 82, 83
 Petrel, Beal, 302
 Forked-tailed, 302
 Kaeding, 68
 Peyton, Sidney B., horned owl attacks
 chickens, 124
 Phaeopus hudsonicus, 22
 Phainopepla, 130, 131
 nitens, 130
 nitens lepida, 39
 Phainopepla, Northern, 39
 Phalacrocorax auritus albociliatus, 70
 pelagicus robustus, 70
 penicillatus, 70, 117
 Phalaenoptilus nuttallii dickeyi, 29
 nuttallii nuttallii, 66
 Phalarope, Wilson, 154
 Phapitreron leucotis, 98
 Phloeotomus pileatus abieticola, 51
 pileatus picinus, 66
 Phoebe, San Lucas Black, 31
 Say, 128
 Pica nuttallii, 84, 85
 Picidae, 82
 Piciformes, 13, 81, 83
 Pickwell, Gayle, the white-tailed kite, 221
 Picoides arcticus arcticus, 216
 tridactylus fasciatus, 216
 Pigeon, 86, 94
 Band-tailed, 219
 Black-chinned fruit, 98
 Blood-breasted, 94
 Fruit, 89
 Gray-breasted fruit, 98
 Philippine Green, 98
 Pink-necked Green, 98
 Northern White-eared, 98
 Pinicola enucleator montana, 262
 Pintail, 99, 265
 Pipilo fuscus aripolius, 38
 maculatus, 51
 Pipit, 76, 99, 144
 Petchora, 99
 Red-throated, 100
 Piranga erythromelas, 217
 ludoviciana, 51
 Pisobia ruficollis, 98
 Pitta atricapilla, 99
 erythrogastra, 99
 Platalea minor, 159
 Plegadis guarauna, 84
 Plover, American Black-bellied, 66
 Belding Wilson, 25
 Golden, 124, 161
 Pacific Golden, 98
 Semipalmated, 11
 Snowy, 25
 Swallow, 99
 Pluvialis dominica dominica, 124
 dominicus dominicus, 161
 dominicus fulvus, 161
 fulvus, 98
 Podilymbus podiceps, 26
 podiceps podiceps, 23
 Poliolimnas ocularis, 98
 Polioptila californica, 126
 melanura margaritae, 48
 Polyborus, 86, 87
 cheriway, 84
 cheriway auduboni, 27
 Poor-will, 66
 San Ignacio, 29
 Porphyrio, 97
 pulverulentus, 98
 Porzana carolina, 24, 210
 plumbea, 98
 Potter, Laurence B., drilling habits of
 the flicker, 125
 Procellariiformes, 13
 Progne subis subis, 161
 subis hesperia, 40
 Psaltriparus minimus, 51
 plumbeus, 72
 Psittaciformes, 13
 Ptarmigan, 206
 Alexander, 11
 Pterocolpa carola, 98
 Ptychoramphus aleuticus, 302
 Puffinus griseus, 117
 Puffin, Horned, 123
 Tufted, 302
 Puñalada, 98
 Pycnonotus goiavier, 99
 Pyrocephalus rubinus mexicanus, 31, 121
 Pyrrherodia manilensis, 99
 Pyrrhuloxia, San Lucas, 38
 Pyrrhuloxia sinuata peninsulae, 38
- Q
- Quail, 85, 89, 268
 Button, 90, 96, 97
 California, 173, 174
 Mountain, 51
 Painted, 96, 97
 San Lucas, 25
 San Lucas California, 25
 San Quintin, 25
 Valley, 25, 51, 53, 76, 142, 171, 211
 Whitehead's Button, 98
 Worcester's Button, 98

Querquedula cyanoptera, 66
discors, 70
querquedula, 99

R

Rail, 12, 89, 90
Black, 211
Blue-breasted, 98
Clapper, 105
Pectoral, 98
Philippine, 98
Sora, 24
Rallina eurizonoides, 98
Raven, 135, 173
Western, 35
Redpoll, 55, 216
Redstart, Painted, 128
Regulus satrapa olivaceus, 102, 103
Rhyacophilus glareola, 98
Richmondia cardinalis ignea, 38
Riparia riparia, 65
Road-runner, 76, 86, 142
California, 27
Robertson, John McB., migratory flight
of Swainson hawks, 127; roads and
birds, 142
Robin, 163, 165, 173
Eastern, 210
Western, 51, 57, 64, 68, 77, 210
Rostratula capensis, 99, 164
Rough-leg, Ferruginous, 200, 259
Rowley, J. Stuart, vermilion flycatcher on
the Pacific slope of southern California,
121; observations on the
dwarf cowbird, 130

S

Sage-hen, 105
Salpinctes obsoletus obsoletus, 46
Sanderling, 154
Sandpiper, 98, 281
Purple, 170
Wood, 98
Sapsucker, Sierra Nevada Red-breasted,
101
Williamson, 119, 120
Sarcops calvus, 100
Sarcoramphus clarki, 84, 87
Sayornis nigricans brunnescens, 31
nigricans nigricans, 31
nigricans salictaria, 31
saya, 128
Scoter, 116, 157
Scotiaptex nebulosa nebulosa, 216
Sefton, J. W., Jr., under-water behavior
of red-throated loons, 261
Selasphorus alleni, 51, 189, 214, 215
floresii, 215
rufus, 189, 215
Setophaga picta, 128
Shearwater, 116, 117

Shoveller, 99
Shrike, 135, 143, 145, 165, 286
California, 144
Great Gray, 163
Loggerhead, 76, 155
Nelson Loggerhead, 42
Nevada Loggerhead, 156
North American, 173
Northern, 68
Sonora Loggerhead, 155
Swallow, 94
Sialia currucoides, 103
sialis, 69
sialis guatemalae, 70
sialis meridionalis, 69
sialis sialis, 69
Silvereye, 89, 96, 97, 99
Siskin, Pine, 55
Sitta canadensis, 101, 103
pygmaea, 70
pygmaea leuconucha, 103
pygmaea melanotis, 103
pygmaea pygmaea, 51
Skinner, M. P., house finches eating water-
melon, 301
Skylark, 100
Smith, Philbrick, winter nesting of the
California Linnet, 121
Snipe, 89, 96
Painted, 99, 164
Swinhoe's, 98, 164
Wilson, 164
Solitaire, 103
Townsend, 57, 102
Sparrow, 219
Brewer, 257
Brown Song, 36
Chipping, 51, 55
Desert Black-throated, 36
English, 17, 36, 77, 137, 138, 140,
141, 143, 144, 145, 306
Fox, 55
Gambel, 55, 56, 67, 144, 145, 170, 212
Golden-crowned, 55, 144, 163, 257,
268
Gray Bell, 36
Harris, 55, 132
Java, 89, 96, 100
Large-billed, 160
Lincoln, 55
Mountain, 159
Nuttall, 55, 75
San Diego Song, 130, 131
Savannah, 144
Song, 17, 55, 75, 217
Timberline, 255, 257
Western Lark, 144
Western Tree, 257
White-throated, 55
Spatula clypeata, 99

- Speotyto, 83, 85
 cunicularia, 84
 cunicularia hypugaea, 258
 Sphyrapius thyroideus, 103, 119
 varius daggetti, 101, 103
 Spinus lawrencei, 64
 pinus pinus, 103
 psaltria hesperophilus, 36
 Spizella breweri, 256
 monticola ochracea, 217, 257
 passerina arizonae, 51
 taverneri, 217, 255
 Spoonbill, Lesser, 159
 Squatarola squatarola cynosurae, 66
 Starling, Bald, 100
 Glossy, 100
 Stellula calliope, 103, 215
 Sterna, 94
 Stevenson, James, some shore-bird notes
 from Ventura, California, 72
 Stint, 96, 98
 Stoddard, Herbert L., and W. L. McAtee,
 American Raptores and the study
 of their economic status, 15
 Stoner, Emerson A., odd bill formation in
 a California horned lark, 159; winter
 record for long-billed dowitchers
 in Suisun marshes, 165
 Storer, Tracy I., twenty-five minutes in
 the life of a selasphorus humming-
 bird, 189
 Streptopelia dussumieri, 98
 Strigidae, 82
 Strigiformes, 13, 81, 83, 85
 Strix occidentalis caurina, 124
 occidentalis lucida, 128
 occidentalis occidentalis, 121
 Sula leucogastra, 159
 neboxii, 160
 Sunbird, 97
 Red-breasted, 99
 Yellow-breasted, 99
 Surf-bird, 72
 Swallow, Asiatic, 99
 Bank, 65
 Cliff, 144, 219, 267
 Northern Violet-green, 67, 137
 San Lucas Violet-green, 40, 41
 Swarth, Harry S., notes on the avifauna
 of the Atlin region, British Co-
 lumbia, 216; nesting of the timber-
 line sparrow, 255
 Swift, White-throated, 11
 Synthliboramphus antiquus, 253
 T
 Tachycineta thalassina brachyptera, 41
 thalassina lepida, 67, 137
 Tanager, Cooper, 210
 Scarlet, 217
 Western, 51, 56
 Tanygnathus lucionensis, 99
 Teal, Blue-winged, 70, 99
 Cinnamon, 66
 European, 99
 Green-winged, 210
 Teratornis, 87
 merriami, 84
 Teratornithidae, 82, 83, 87
 Tetraonidae, 152, 153
 Thrasher, Bendire, 43
 California, 129
 Cape San Lucas, 43
 Desert, 42, 45
 Mearns San Lucas, 43
 Sage, 11, 263
 San Lucas, 45
 Santa Rosalia Leconte, 45
 Sonoma, 50
 Western, 56
 Thrush, 92
 Dwarf Hermit, 57
 Fruit, 89, 90
 Hermit, 103, 135, 213
 Russet-backed, 57, 131
 Sierra Nevada Hermit, 101
 Varied, 57, 172
 Titmouse, Plain, 50, 57
 Towhee, Brown, 55, 56, 144
 Green-tailed, 56
 San Diego, 131
 San Pablo Brown, 38
 Spotted, 51, 56, 170
 Toxostoma bendirei, 43
 cinereum cinereum, 43
 cinereum mearnsi, 43
 lecontei arenicola, 45
 lecontei lecontei, 45
 redivivum, 129
 redivivum sonomae, 50
 Tringa solitaria "cinnamomeus", 135
 Trochilus violajugulum, 215
 Troglodytes aëdon parkmanii, 51, 137
 Trotter, Robert T., woodpeckers and wires,
 214
 Turdus migratorius, 165
 migratorius propinquus, 51, 64, 68,
 77, 103, 163
 Turkey, 83, 87
 Merriam, 86
 Wild, 86
 Turnix, 90, 96
 ocellata, 97
 fasciata, 97
 whiteheadi, 98
 worcesteri, 98
 Turnstone, Black, 72
 Ruddy, 72
 Tyto, 27, 84, 86, 99
 alba, 84
 alba pratincola, 27, 258
 longimembris, 99
 Tytonidae, 82, 83

U

Uintornis lucaris, 13

V

Von Bloeker, Jr., Jack C., new records of horned larks from southern California, 161

Van Rossem, A. J., a new race of red-winged blackbirds from Costa Rica, 162; critical notes on some yellow-throats of the Pacific southwest, 297; a northwestern race of the Mexican goshawk, 303

Van Rossem, A. J., and Donald R. Dickey, a new bluebird from El Salvador, 69; the identity of *Ortyx leucopogon* Lesson, 72

Verdin, Cape, 46, 48

Vermivora celata lutescens, 51
peregrina, 119

Vireo bellii pusillus, 131

huttoni, 240

solitarius cassinii, 51

Vireo, California Least, 131

Cassin, 51

Hutton, 240, 241, 267

Western, 56

Vorhies, Chas. T., the Rocky Mountain Pine grosbeak in Arizona, 262

Vulture, Black, 87

Northern Turkey, 27

Turkey, 116, 223, 230

W

Warbler, Audubon, 51, 56, 306

Bay-breasted, 306

California Yellow, 130, 131

Dusky, 211

Golden Pileolated, 51

Hermit, 306

Lucy, 210

Lutescent, 51, 119

Mangrove, 76

Mangrove Golden, 42

Marsh, 94

Pileolated, 211

Red-faced, 128

Tennessee, 119

Townsend, 117

Yellow, 119, 137, 140, 141

Waxwing, Bohemian, 135

Cedar, 56, 64, 214

Weaver, 89, 94, 96, 100

Everett's, 100

Wells, Caroline, Say phoebe nesting in western Montana, 128

Wetmore, Alexander, the fossil birds of the A. O. U. Check-List, 12; two fossil birds from the Miocene of Nebraska, 152

Wetmore, A. and H. T. Martin, a fossil crane from the Pliocene of Kansas, 62

Wetmoregyps daggetti, 84

Weydemeyer, Winton, an unusual case of mimicry by a catbird, 124

Wheatear, 130

Whimbrel, 98

Whydah-bird, Yellow-mantled, 166

Widgeon, European, 65

Willett, G., least bittern in California in winter, 64; the large-billed sparrow at Salton Sea, 160; the common mynah breeding in Los Angeles, 301

Wilsonia pusilla chryseola, 51

pusilla pileolata, 211

Woodpecker, 83, 286

Cabanis, 51

California, 129, 214, 219, 264

Downy, 173

Gila, 53

Hairy, 173, 264

Lewis, 66, 129, 263, 264, 268

Northern Pileated, 51

Pileated, 64

Rocky Mountain Hairy, 64

San Fernando Ladder-backed, 28

San Lucas Gila, 28

San Lucas Ladder-backed, 28

Three-toed, 135

Western Pileated, 66

White-headed, 103

Woods, Robert S., two more victims of the cowbird, 126; wasp eaten by a mockingbird, 129; an early seasonal record for the Allen hummingbird, 214

Wren, Bewick, 213

Cactus, 142

Cañon, 11, 46, 117

Dotted Cañon, 46

House, 56

Northern Rock, 46

San Lucas Cactus, 45

Vigors, 56

Western House, 51, 137, 139

Wren-tit, 50, 57

Pallid, 131

X

Xenopus albolaryvatus albolaryvatus, 103
albolaryvatus gravirostris, 103

Y

Yellow-throat, Goldman, 42

Goldman Belding, 42

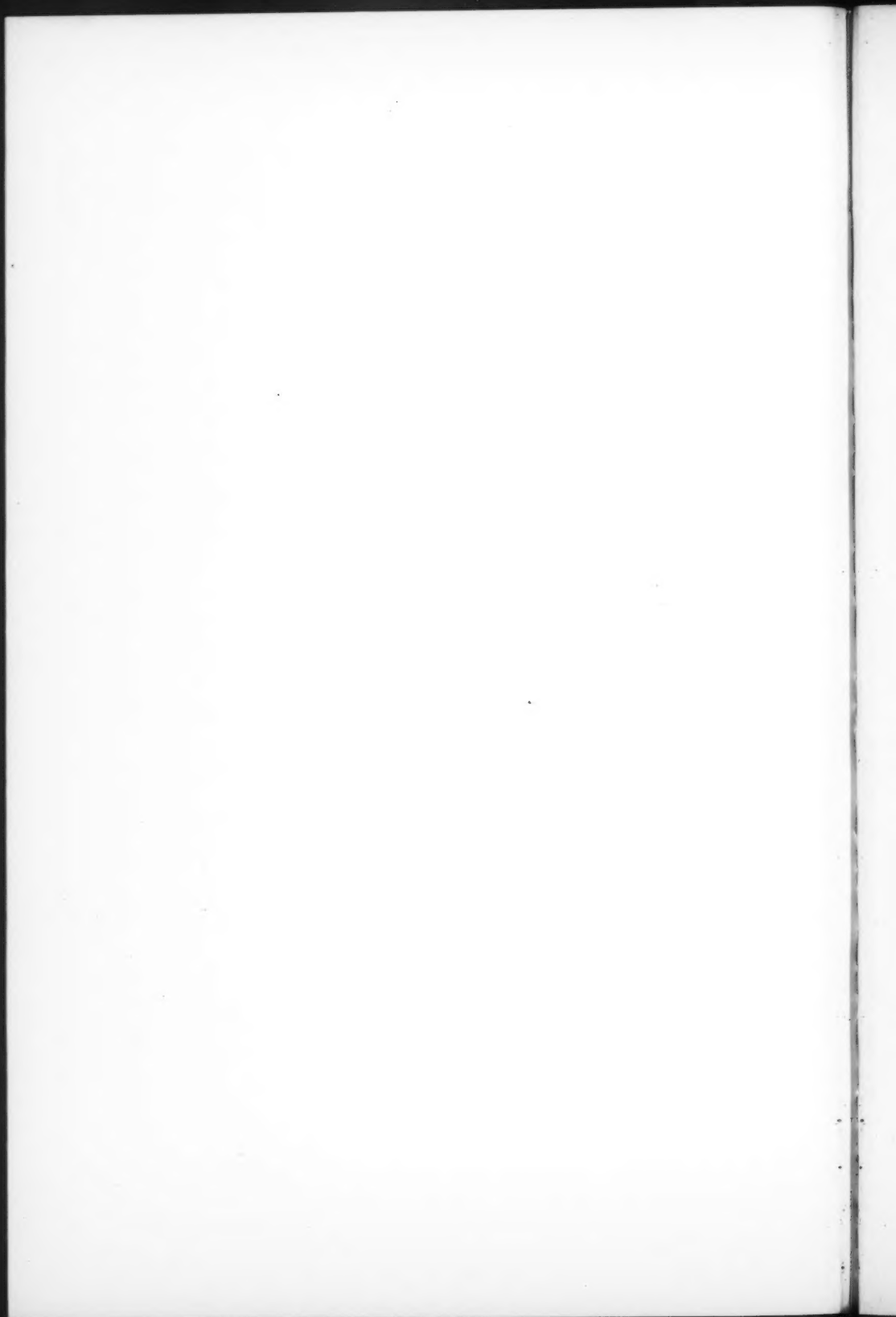
Pacific, 131

Salt Marsh, 42

Tule, 42

Z

- Zamelodia melanocephala, 262
 melanocephala capitalis, 51
Zenaidura, 86
 macroura, 84
 macroura marginella, 25
Zonotrichia leucophrys gambeli, 67
 leucophrys leucophrys, 103
Zosterops, 96, 97
 meyeni, 99



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